Thermo Scientific

TSE Series -86C Ultra Low Temperature Freezer

Operating and Maintenance Manual 7020933 Rev. 2



Important installer and user information:

A redundant temperature sensing device has been included in this ULT freezer. This device is a type "T" thermocouple. For convenient access, the thermocouple (Figure 1-3) terminates in an interconnect jack (Figure 1-5) behind the base front cover. (May be located differently in chests. See Section 1.) It is strongly recommended that this thermocouple be attached to a redundant 24 hour 7 day monitoring system with alarm capabilities. Connecting the sensor to a monitoring and alarm system separate from the freezer provides the utmost in product safety, should the integral system fail. ▲

Models Covered

Number (Model)	Capacity - liters (cubic feet)	Voltage /Hz
TSE240V (933)	368 (13)	230/50
TSE240D (947)	368 (13)	230/60
TSE240A (930)	368 (13)	120/60
TSE320A (931)	490 (17)	120/60
TSE320D (948)	490 (17)	230/60
TSE320V (935)	490 (17)	230/50
TSE400V (936)	652 (23)	230/50
TSE400D (949)	652 (23)	230/60
TSE400A (932)	652 (23)	120/60
TSE600D (937)	793 (28)	230/60
TSE600V (950)	793 (28)	230/50

Packing List

Part No.	Description	Qty
34040	Key Ring	1
122005	Key	2
380520	Neoprene Cap	2
510016	1/4-20 x 5-1/2" Bolt	2
195763	Retaining Clip	1
370563	Remote Alarm Connector	1

MANUAL NUMBER 7020933

2	FR-2361	5/10/12	Run cap chg - 230V elec schematic, start components expl drawing	ccs
1	FR-2267	2/10/12	Updated refrigeration schematics	ccs
0	FR-2267	1/4/12	Compressor change - Release 7	ccs
REV	**ECR/ECN**	**DATE**	**DESCRIPTION**	**By**

CAUTION

Contains Parts and Assemblies Susceptible to Damage by Electrostatic Discharge (ESD)

Important Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

Caution All internal adjustments and maintenance must be performed by qualified service personnel. ▲

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Important operating and/or maintenance instructions. Read the accompanying text carefully.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Extreme temperature hazards, hot or cold. Use special handling equipment or wear special, protective clothing.



Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.



Marking of electrical and electronic equipment, which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005.

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the WEEE symbol. Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State European Country, and this product should be disposed of or recycled through them. Further information on Thermo's compliance with this directive, the recyclers in your country and information on Thermo products will be available at www.thermofisher.com.

- ✔ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- ✔ Always dissipate extreme cold or heat and wear protective clothing.
- ✔ Always follow good hygiene practices.
- ✔ Each individual is responsible for his or her own safety.

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Our **Sales Support** staff can provide information on pricing and give you quotations. We can take your order and provide delivery information on major equipment items or make arrangements to have your local sales representative contact you. Our products are listed on the Internet and we can be contacted through our Internet home page.

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Whatever Thermo Scientific products you need or use, we will be happy to discuss your applications. If you are experiencing technical problems, working together, we will help you locate the problem and, chances are, correct it yourself...over the telephone without a service call.

When more extensive service is necessary, we will assist you with direct factory trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

Thermo Fisher Scientific
401 Millcreek Road, Box 649
Marietta, OH 45750

International customers, please contact your local Thermo Scientific distributor.

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Section 1 Installation and Start-up

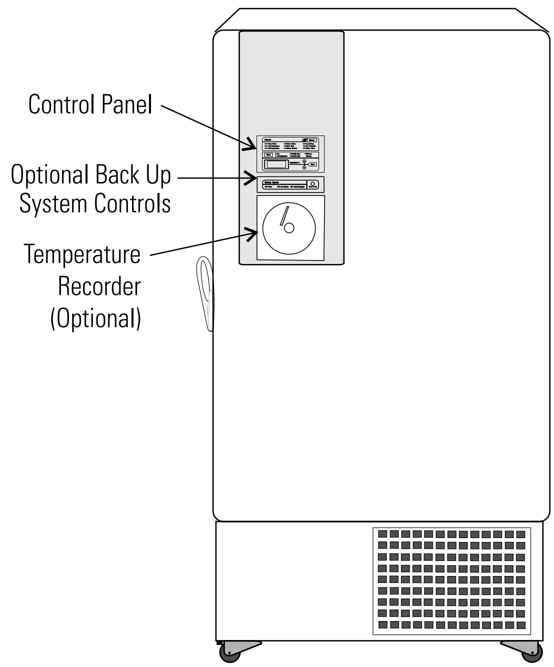


Figure 1-1. Freezer Front View Components

- Control panel - keypad, displays and indicators
- BUS (Optional Back Up System) control panel
- Optional temperature recorder or datalogger

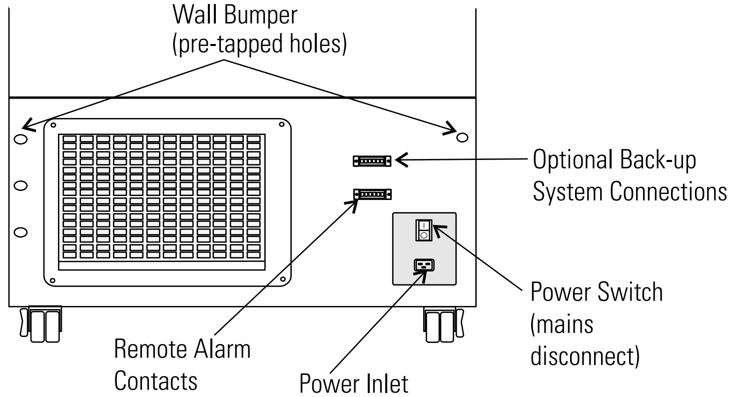


Figure 1-2. Freezer Rear View Components

- Remote alarm contacts
- Power inlet for power cord connection
- Optional BUS connections for probe and solenoid
- Power switch (mains disconnect)

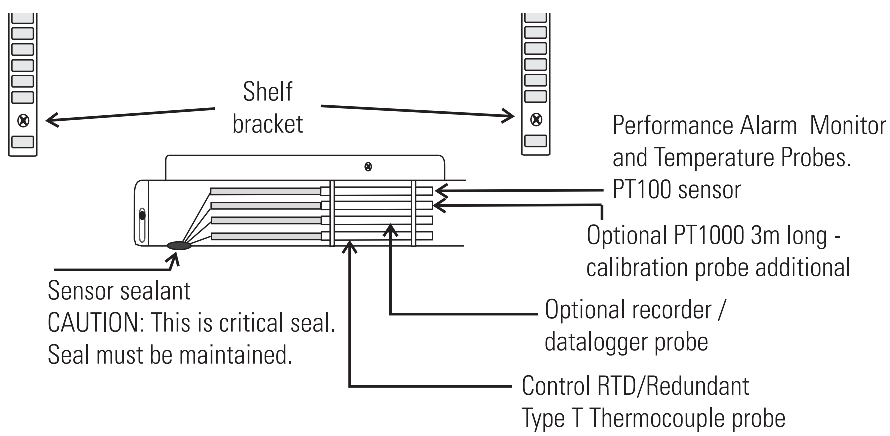


Figure 1-3. Chamber Probe(s)

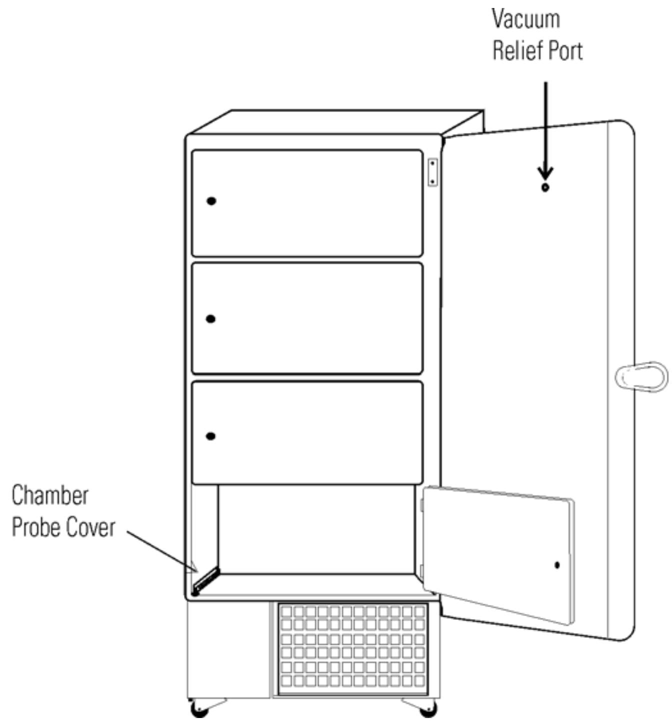


Figure 1-4. Vacuum Relief and Probe Cover Location

- Vacuum relief port - pressure equalization port
- Probe cover - houses control, optional recorder, datalogger, or 1535 alarm probes

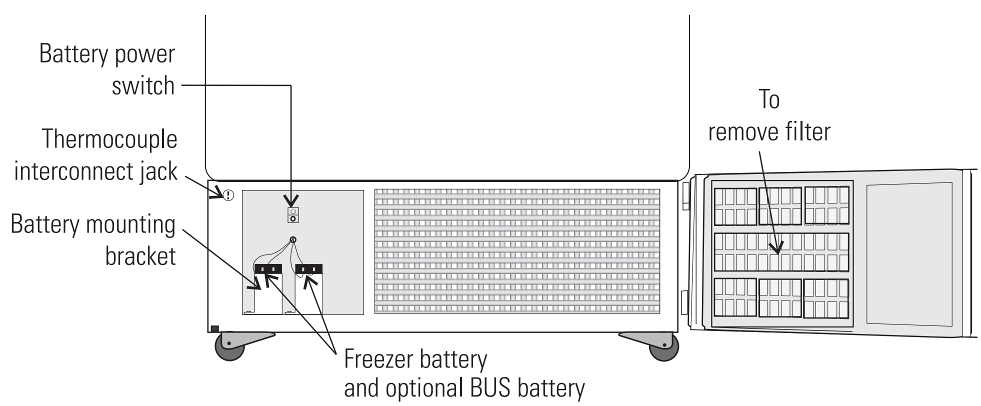


Figure 1-5. Battery(s) location and switch

- Battery mounting bracket(s)
- Battery power switch (freezer and BUS)
- Freezer battery
- Optional BUS battery
- Freezer filter location

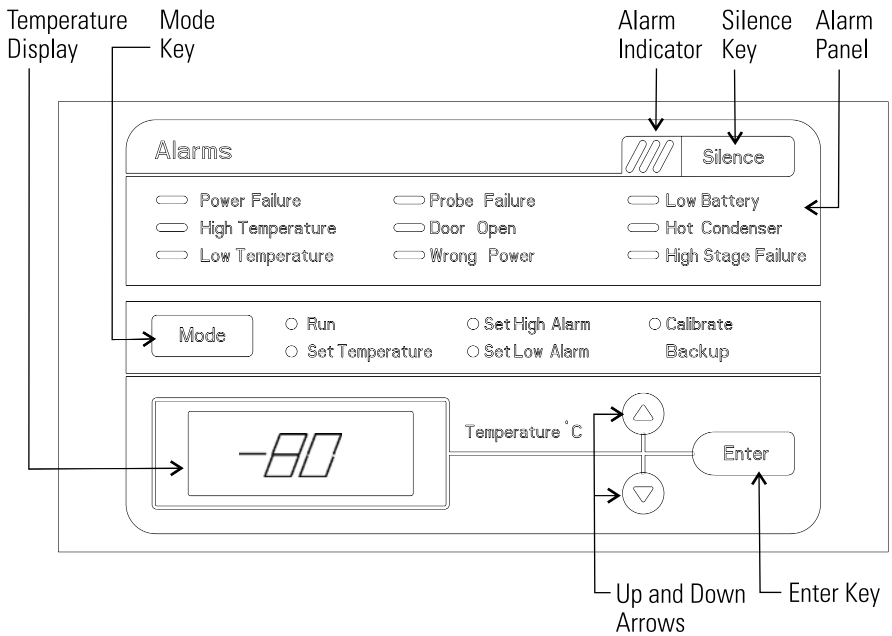


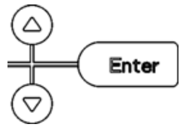
Figure 1-6. Control Panel

Control Panel Keys, Displays, Indicators

- Temperature Display - Displays temperature in degrees Celsius.
- Mode Select Switch - Used to select Run, Set Temperature, Set High Alarm, Set Low Alarm, Calibrate, Backup.
- Alarm Indicator - Light pulses on/off during an alarm condition of the cabinet.
- Silence - Silences the audible alarm. See Section 4 for alarm ringback times.
- Alarm Panel - indicates the current alarm condition.
- Up and Down Arrows - Increases or decreases values, toggles between choices.
- Enter - Stores the value into memory

Operation of the Keypad

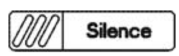
The TSE Series freezer has five basic modes which allow freezer setup and operation. Press the Mode key to scroll through the mode selections.



Up Arrow: Increases or toggles the parameter value.

Enter: Must press Enter key to save to memory all changed values.

Down Arrow: Decreases or toggles the parameter value.



Silence Key: Press to silence the audible alarm. See Section 4 for alarm ringback times.

Install Freezer

Note If tipped more than 45°, allow the unit to sit upright for 24 hours before start up. ▲

To remove the freezer from the pallet, use a 7/16" wrench to remove all the bolts securing the shipping bracket to the pallet.

Remove the shipping bracket. Remove the ramp boards from the pallet and place the slotted end over the ramp brackets on the pallet. The support blocks on the ramps will be facing down. Before moving the freezer, make sure the casters are unlocked and moving freely. Align the caster with the ramp boards. Use adequate personnel to roll the freezer off the pallet.

Choose Location

The freezer can be easily pushed to the desired approved location, described below. If necessary, the doors and lower front panel may be opened to move the unit through tight openings. When the freezer is in position, set the front caster brakes.

Note The freezer must not be moved with the product load inside. ▲

Note For proper ventilation and airflow, a minimum clearance of 5” at the rear and top and a clearance of 8” on the side of the freezer is required. Allow adequate space in the front of the freezer for door opening. ▲

Locate the freezer on a firm, level surface in an area with an ambient temperature between 18°C and 32°C. Provide ample room to reach the mains disconnect switch (power switch) located on the rear of the freezer.

Install Wall Bumpers

The parts bag, located inside the cabinet, contains the following parts.

Quantity	Stock #	Description	Purpose
2	510016	1/4-20 x 5-1/2" Bolt	Wall Bumper
2	380520	Neoprene Cap	Cap Protector

Table 1-1. Parts bag

Install the bolts into the pre-tapped holes on the back of the compressor section. Install a neoprene cap on each bolt. Refer to Figure 1-2 for the locations of the pre-tapped holes.

Install Shelves

Install the shelf clips into the shelf pilasters (front and back) at the desired shelf level. Install the shelves in the cabinet onto the clips.

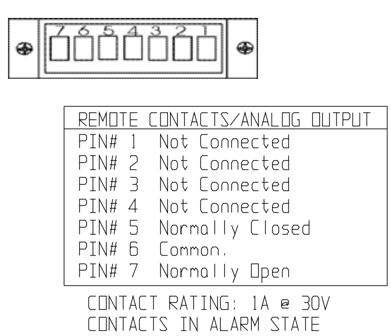
Note Maximum shelf load is 100 lbs (45.4 kg) per shelf. ▲

Note On units having the optional 5 inner door option, refer to the instructions accompanying the inner door kit. ▲

Remote Alarm Contacts

See Figure 1-2 for the location of the remote alarm contacts. The remote alarm connector is located in the parts bag provided with the manual. It must be installed if connecting the freezer to an alarm system. After installing the wiring from the alarm system to the connector, install the connector to the freezer microboard and secure with the two screws provided. The remote alarm provides a NO (normally open) output, a NC normally closed) output and COM (common). The contacts will trip on a power outage and high temperature or low temperature alarms. They will also trip on high stage, control probe or microboard failures.

Figure 1-8 shows the remote contacts in <u>alarm state.</u>



IMPORTANT USER INFORMATION

Caution! Stored product should be protected by a redundant 24 hour/day monitoring system with alarm capability. An interconnect jack and thermocouple are installed for centralized monitoring, should on-board system fail.

Figure 1-8. Remote Alarm Contacts

Attach Power Cord

Insert the power cord into the power inlet module. Place the retaining bracket (P/N 195763) over the connector. Tighten retaining screws to secure.

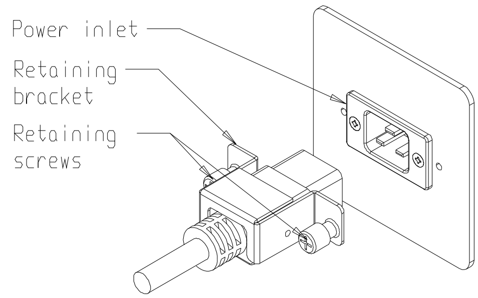


Figure 1-9. Power Cord Connection

Connect Unit to Electrical Power

See the serial tag on the side of the unit for electrical specifications or refer to the electrical schematics in this manual. ▲

The freezer should be operated on a dedicated grounded service. Check the voltage rating on the serial tag of the unit and compare it with the outlet voltage. Then, with the power switch turned off, plug the line cord into the wall outlet.

First, turn on the freezer power switch. Then open the lower front door by grasping the bottom left corner. Locate the battery switch (Figure 1-5) and turn it to Standby mode (⏻). During initial freezer start-up, the system battery may require charging and the Low Battery indicator may illuminate.

Note Ensure the battery switch is turned to Standby mode (⏻). The rechargeable batteries require 36 hours to charge at initial start-up. A "Low Battery" alarm may occur until the batteries are fully charged. Should a power failure occur during the initial start-up period, the electronics will have limited operation. ▲

Freezer Start-Up

With the freezer properly installed and connected to power, system set points can be entered. The following set points can be entered in Settings mode: Control temperature, high temperature alarm set point, low temperature alarm set point, and (optional) BUS set point. Default settings are shown in the table below.

Table 1-2. Default Settings

Default Settings	Temperature
Control Set Point	-80°C
High Temperature Alarm	-70°C
Low temperature alarm	-90°C
Optional BUS Set Point	-60°C

Note If the set point is changed and the low temperature and high temperature alarms are set 10° from the set point, the alarm set points will be adjusted automatically to maintain a distance of at least 10° from set point. ▲

Set Operating Temperature

TSE Series freezers have an operating temperature range of -50°C to -86°C, depending on ambient temperature. The freezer is shipped from the factory with a temperature set point of -80°C. To change the operating temperature set point:

1. Press the Mode key until the Set Temperature indicator lights.
2. Press the up/down arrow key until the desired temperature set point is displayed.
3. Press Enter to save the set point.
4. Press the Mode key until the Run indicator lights for Run mode

If no keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Note If the set point is changed and the low temperature and high temperature alarms are set 10° from the set point, the alarm set points will be adjusted automatically to maintain a distance of at least 10° from set point. ▲

Set High Temperature Alarm

The high temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or exceeded the high temperature alarm set point.

To set the high temperature alarm set point:

1. Press the Mode key until the Set High Alarm indicator lights.
2. Press the up or down arrow key until the desired high temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Note The high alarm set point must be set at least 5°C from the control set point. ▲

Note At initial start-up, the high temperature alarm is disabled until the cabinet reaches set point or 12 hours elapse. ▲

Set Low Temperature Alarm

The low temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or decrease below the low temperature alarm set point.

To set the low temperature alarm set point:

1. Press the Mode key until the Set Low Alarm indicator lights.
2. Press the up or down arrow key until the desired low temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Note The low alarm set point must be set at least 5°C from the control set point. ▲

Run Mode

Run mode is the default mode for the freezer. This mode displays the cabinet temperature on the temperature display under normal operating conditions. In addition, the Run mode allows display of the high stage heat exchange temperature.

This information scrolls by pressing the up or down arrow keys. The display returns to the operating temperature in 10 seconds if no keys are pressed.

Section 2 Calibrate

Once the freezer has stabilized, the control probe may need to be calibrated. Calibration frequency is dependent on use, ambient conditions and accuracy required. A good laboratory practice would require at least an annual calibration check. On new installations, all parameters should be checked after the stabilization period.

Caution Before making any calibration or adjustments to the unit, it is imperative that all reference instruments be properly calibrated. ▲

Calibrate Control Probe

Plug a type T thermocouple reader into the receptacle located inside the lower door (see Figure 1-5). Compare the control temperature set point to the temperature of the measuring device.

1. Press the Mode key until the Calibrate indicator lights.
2. Press up/down arrow to match the display to calibrated instrument.
3. Press Enter to store calibration.
4. Press the Mode key to return to Run mode.

Temperature Stabilization Periods

Startup - Allow 12 hours for the temperature in the cabinet to stabilize before proceeding.

Already Operating - Allow at least 2 hours after the display reaches set point for temperature to stabilize before proceeding.

During calibration, the temperature display will not be available. ▲

If no keys are pressed for approximately five minutes while in calibration mode, the system will reset to Run mode.

Section 3 Alarms

The TSE Series freezer alarms are displayed on the freezer control panel. When an alarm is active, the indicator next to the alarm description will light and there will be an audible alarm. Press the Silence key to disable the audible alarm for the ringback period. The visual alarm will continue until the freezer returns to a normal condition. The alarms are momentary alarms only. When an alarm condition occurs and then returns to normal, the freezer automatically clears the alarm condition.

Table 3-1. Alarm Indicators

Description	Delay	Ringback	Relay
Power Failure	1 min.	15 min.	Yes
High Temperature Alarm	1 min.	15 min.	Yes
Low Temperature Alarm	1 min.	15 min.	Yes
Probe Failure see 3.2	1 min.	15 min.	No
Door Open	1 min.	15 min.	No
Wrong Power	0 min.	none	Yes
Low Battery*	1 min.	8 hours	No
Low BUS Battery (optional)	1 min.	15 min.	No
Hot Condenser	1 min.	none	No
High Stage Failure	0 min.	15 min.	Yes
Micro Board Failure	0 min.	15 min.	Yes

All alarm delays and ringback times are ±30 seconds.
** The automatic battery test runs immediately on power-up, then every 8 hours thereafter.*

High Stage System Failure

The "high stage system failure" condition is created when the high stage compressor and fans run for 30 minutes and are not capable of cooling the interstage heat exchanger to the proper temperature. Under this condition, the high stage compressor and fans will turn off after 30 minutes and an audible and visual alarm will occur. The audible alarm can be silenced and will ring back every 15 minutes.

Probe Failure Alarm

The microprocessor in TSE Series freezers continually scans all probes including the control probe, heat exchanger probe and condenser probe to ensure that they are operating properly. Should an error be detected, the "Probe Failure" alarm will occur as described above. If an error is detected with the control probe, the high and low stage compressors will run continuously. As a result, the cabinet temperature will decrease until it reaches the lowest temperature that the refrigeration system can maintain. If an error is detected with the heat exchanger probe, the freezer will cycle properly at its temperature set point using a 5 minute step start between the high and low stage compressors. If an error is detected with the condenser probe, there is no impact on the performance of the freezer; however, the hot condenser alarm may also occur. Contact the Technical Services department or your local distributor.

Error	Notes
Er00	**Name:** Improper model selected. **Description:** Indicates that DIP SW3 has not selected a proper model or can't be accessed properly. **Response:** Display shows "Er00" and will not start-up until a proper model is selected. Contact Technical Services.
ErA1 ErC1 Erd1 ErE1 ErF1 Erg1 ErH1	This error condition will prevent peripherals (fans, compressors, etc.) from powering up with the incorrect voltage. **Name:** Voltage/Frequency failure **Description:** Indicates the measured RMS line voltage did not agree with the logic level sensed by the micros provided by the installed high voltage PCB; or the measured RMS voltage is not within a tolerable range (180 < Vac < 270 for 230VAC unit / 85 < Vac < 160 for 115VAC unit); or the frequency measured over 10 cycles was not within a tolerable range (55 Hz < Freq < 70 Hz for 60 Hz units / 40 Hz < Freq < 55 Hz for 50 Hz units) **Response:** This condition is checked at power on reset and if it is active, the unit will NOT power up. The unit will indefinitely display "Er_1" in the display and continue to monitor the frequency and voltage. Furthermore, the audible alarm will sound. Other startup error messages may be displayed prior to this message; however, the system will stop the startup sequence for this condition. ErA1 .. No pulses (zero crossings) detected to determine frequency (50 / 60 Hz) ErC1 .. Frequency detected is below 50 Hz Erd1 .. Frequency detected is above 60 Hz (possible noise spikes on supply voltage) ErE1 .. Unit is 230V and the voltage detected is below the low limit (180VRMS) ErF1 .. Unit is 230V and the voltage detected is above the high limit (260VRMS) Erg1 .. Unit is 115V and the voltage detected is below the low limit (85VRMS) ErH1 .. Unit is 115V and the voltage detected is above the high limit (160VRMS)
Er02	**Name:** Control (Cabinet) Sensor Failure **Description:** This condition indicates that the control sensor has failed to produce a valid reading for $\geq$12 consecutive reads (~60 seconds). **Response:** The unit will stage both compressors on (if necessary) and the unit will attempt to head to bottom out. If the sensor recovers, the system will begin to operate normally and respond to the temperature feedback. The remote alarm contacts will become active. 'Er02' will be added to the main display queue and the last valid cabinet temperature value will not be displayed.
Er03	**Name:** Heat Exchange Sensor Failure **Description:** This condition indicates that the heat exchange sensor has failed to produce a valid reading for $\geq$12 consecutive reads (~60 seconds). **Response:** The display will show "Er03" only when the button sequence to read the heat exchange sensor is depressed.

Error (cont.)	Notes
Er05	**Name:** Display Firmware Integrity Failure **Description:** The display firmware has failed to pass its CRC CCITT checksum integrity test. **Response:** The display performs this check at startup and the display board will fail to startup without any error indication if it does not pass this at power on.
Er06	**Name:** Micro Firmware Integrity Failure **Description:** The micro firmware has failed to pass its CRC CCITT checksum integrity test. **Response:** This is checked at power on reset and the "Er06" will be displayed for ~10 seconds at startup if this condition exists.
Er07	**Name:** Micro Fail - CS5521 SPI Failure / UISR Failure **Description:** This condition indicates a micro board failure due to either the SPI bus is unable to communicate with the ADC device or a UISR event caused the microcontroller to be in an unstable state. **Response:** The unit will try to recover from this fault three times by a hardware reset of the micro board. In the event that the system couldn't rectify the issue, the following sequence of events will occur: 1. Remote alarm contacts will become active. 2. Buzzer will annunciate audibly and will have a ringback of 15 minutes. 3. "Seven segment" display will show "Er07". 4. The system will have 10 minute staging between the high stage compressor and the low stage compressor activation. 5. The system will go to bottom out temperatures.
Er09	**Name:** Stuck Button **Description:** This condition indicates that the display board has a stuck button. **Response:** The Er09 will show on the display periodically.
Er11	**Name:** Condenser Probe Sensor Failure **Description:** This condition indicates that the condenser probe sensor has failed to produce a valid reading for $\geq$12 consecutive reads (~60 seconds). **Response:** The display shows "Er11".
dErr	**This is a general display error in which value being displayed can not be represented within characters provided.**
(Four dashes) ---- in display	**Name:** Lost Communication **Description:** Communication between the micro board and the display board has been lost. Under this condition, the visual alarm flashes along with dashes in the temperature display (----). Contact Technical Services.

Section 4 Maintenance

Clean Cabinet Exterior

Wipe down the freezer exterior using soap and water and a general use laboratory disinfectant. Rinse thoroughly with clean water and dry with a soft cloth.

Caution Avoid the excessive use of water around the control area due to the risk of electrical shock. Damage to the controls may also result. ▲

Clean Air Filter

The air filter should be cleaned four times a year, minimum.

1. Open the front lower door by grasping the bottom left corner.
2. Locate the grille on the door. See Figure 4-1. Grasp the middle of the grille material and gently pull out to remove.
3. Wash the filter material using water and a mild detergent.
4. Dry by pressing between two towels.

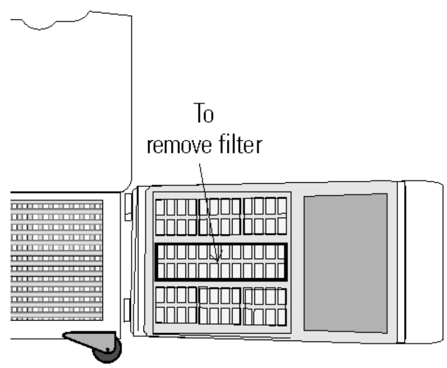


Figure 4-1. Grille with Filter Location

5. Install the filter back into the grille and attach the grille.

Clean Condenser

The condenser should be cleaned once per year, minimum.

1. Open the front lower door by grasping the bottom left corner.
2. Using a vacuum cleaner, exercising care to not damage the condenser fins, clean the condenser.

Depending upon environmental conditions, the condenser may need to be cleaned more frequently.

Clean Water-cooled Condenser

The water-cooled condenser can be cleaned-in-place by using the CIP procedure. Cleaning solutions can be used, depending on type of deposits or build-up to be removed.

Note Do not use liquids that are corrosive to stainless steel or the brazing material (copper or nickel). ▲

CIP (Clean-In-Place) Procedure

1. Disconnect the unit from the water supply.
2. Drain the unit.
3. Rinse with fresh water and drain the unit again.
4. Fill with fresh water.
5. Add cleaning agent (solution and concentration dependent on deposits or build-up).
6. Circulate cleaning solution (if feasible).
7. Drain the cleaning solution.
8. Add and circulate a passivating liquid for corrosion inhibition of plate surfaces.
9. Drain this liquid.
10. Rinse with fresh water and drain.
11. Reconnect the water supply and fill the unit.
12. Return to service.

Defrost Chamber

1. Remove all product and place it in another freezer.
2. Turn the unit off and disconnect it from the power source.
3. Turn off the battery switch (O). See Figure 4-6.
4. Open all of the doors and place towels on the chamber floor.
5. Allow the frost to melt and become loose.
6. Remove the frost with a soft cloth.
7. After defrosting is complete, clean the interior with a non-chloride detergent. Rinse thoroughly with clean water and dry with a soft cloth.
8. Plug unit in and turn power switch on.
9. Turn the battery power switch to Standby mode (⏻).
10. Allow the freezer to operate empty overnight before reloading the product.

Clean Door Gasket

The door gasket should be cleaned monthly, minimum. Using a soft cloth, remove any frost build-up from the gasket and door(s). The door gasket may need to be cleaned more frequently if dirt or excessive frost build-up prevents the door from closing properly.

Vacuum Relief Port

The exterior door gasket provides an excellent seal to protect product, provide an energy efficient thermal barrier to keep cold air in and room temperature air out, and reduce frost build up on the inner doors.

Because the door gasket seals so well, a vacuum can be created after a door opening. Warm air enters the cabinet, cools and contracts, creating a vacuum that pulls the door in tightly against the seal.

To equalize the pressure inside the cabinet after a door opening requires 1.5-3.0 cu.ft. of ambient air to be drawn into the cabinet. The amount of air required to equalize the pressure varies depending on the cabinet size, cabinet temperature, duration of door opening, inventory volume and the temperature/humidity of the ambient air. The unit is designed with a “vacuum relief port” that allows the pressure to be equalized.

Vacuum Relief Port (continued)

The time required to draw 1.5-3.0 cu.ft. of air into the cabinet depends on two factors:

a) the size and number of paths available for the air to enter the cabinet, and
b) the pressure difference between the internal cabinet and the ambient room.

Cabinets with the vacuum relief port operating normally, (i.e. vacuum relief port is not iced over) will require a minimum of 30 seconds up to a maximim of 120 seconds for the cabinet to equalize. This is also a good indication that the exterior door is well sealed.

The vacuum relief port requires routine maintenance. It will ice over unless preventive measures are taken. If the vacuum relief port becomes iced over, the freezer will take several hours to equalize pressure.

Warning Do not leave the freezer unattended while the door is unlatched. The vacuum could release, resulting in a door opening and product loss. ▲

Observe the inner side of port periodically for frost and ice build-up. Remove any frost with a soft dry cloth. If the tube should become clogged with ice, it must be cleaned. **Make sure during cleaning that the vacuum relief tube is completely free of ice to prevent rapid ice formation.**

Factors that can affect the performance of the vacuum relief port include: high ambient temperature, high humidity conditions and frequent door openings. Maintenance should be performed weekly or as needed.

Warning Failure to maintain the vacuum relief port may result in excessive ice build up inside the tube, clogging the port, and inability to open the door. The vacuum relief port may need to be cleaned more often with frequent door openings and high humidity environments. ▲

Replace Battery(s)

1. To gain access to the battery, open the lower door by grasping the bottom left corner. The battery is rectangular in shape, located on the front left corner of the compressor compartment and is secured in place by a mounting bracket.

2. Directly above the battery(s) is the battery power switch. Turn the battery power switch to the off position (O).

3. Disconnect the battery connections.

4. Remove the old battery and install the new battery.

6. Reconnect the battery (red to positive and black to negative).

7. Turn the battery power switch to Standby mode (⏻).

8. Close lower panel door.

Warning The % of charge can vary depending on the age, usage and condition of the battery. For a consistent and dependable charge, replace the battery every 2 years. Replacement batteries must be rechargeable and are available from Thermo. Refer to the parts list for stock number and description of the replacement batteries. Dispose of the used batteries in a safe manner and in accordance with good environmental practices. ▲

Prepare Unit for Storage

Defrost the unit as described in 'Defrost Freezer'. This will prepare the unit for storage. Turn off the battery power switch (O). Turn off the freezer power switch. Disconnect power to the battery(s) and to the freezer.

Note If the unit has been in service, turn it off and disconnect the power cord connector before proceeding with any maintenance. ▲

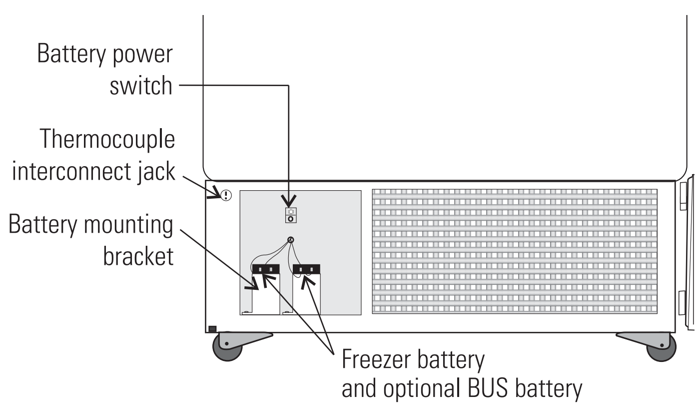


Figure 4-6. Battery Power Switch

PREVENTIVE MAINTENANCE
Freezers

Your equipment has been thoroughly tested and calibrated before shipment. Regular preventive maintenance is important to keep your unit functioning properly. The operator should perform routine cleaning and maintenance on a regular basis. For maximum performance and efficiency, it is recommended that the unit be checked and calibrated periodically by a qualified service technician.

The following is a condensed list of preventive maintenance requirements. See the specified section of the instruction manual for further details.

We have qualified service technicians, using NIST traceable instruments, available in many areas. For more information on Preventive Maintenance or Extended Warranties, please contact the Technical Services Department. Cleaning and calibration adjustment intervals are dependent upon use, environmental conditions and accuracy required.

Tips:

- Fill an upright by starting at the bottom near the probe and add racks to one shelf at a time. Allow freezer to recover to set point between shelves.
- Fill a chest by starting at the left side near the probe. Filling with room temperature racks will result in a long pull-down time.
- Fill unit with frozen product to help overall performance; frozen water jugs, for example.
- Always make certain the vacuum relief port is free of frost and ice, to allow for timely re-entry into the freezer after a door opening.

Action	Monthly	Yearly	Every 2 Years
Verify ambient temperature, <90°F	✔		
* Adjust door handle for firm latching, as needed	✔		
Check and clean probe cover, gaskets, hinges and lid(s) of ice and snow. See Figure 1-4 for probe location. See “Cleaning the Lid Gasket”.	✔ *More frequent cleaning may be required, depending on use and environmental conditions.*		
Check air filter. Clean or replace as needed. See “Cleaning the Air Filter”.		✔ 4X	
Check alarm back-up battery. See “Connecting the unit to Electrical Power” in Section 1 and “Replacing the Battery” in Section 4.	✔		**Replace
Check condenser fan motor for unusual motor noise or vibration.		✔	
* Verify and document calibration, at the minimum, annually. See Section 2 Calibration.		✔	
* Clean condenser compartment and wipe off condenser See “Cleaning the condenser” in Section 4.		✔	

** Qualified service technicians only*
*** Dispose of properly, according to all state and federal regulations.*

To minimize ice build-up inside of freezer:

- Locate the freezer away from drafts or heating/cooling vents
- Keep the number of door openings to a minimum
- Minimize the length of time door is open
- Make sure door latches securely after opening

Section 5 Factory Installed Options

Back Up System (BUS) - P/N 1950445, 1950447

Note Before installation of BUS components, make sure the power to the freezer is disconnected, the battery switch is turned off (O) and the freezer has warmed to ambient temperature. ▲

The built-in BUS (back up system) maintains the freezer chamber temperature below the critical level in the event of a power or equipment failure. If power to the freezer fails, or temperature increases to the back up alarm set point, the BUS injects liquefied gas into the chamber to keep the chamber temperature within the specified range.

The BUS operates on an internal 12-volt, rechargeable battery which is kept charged during normal operation by the integral battery charger.

Install Vent Stack, Solenoid and Injection Assembly

1. Install the injection assembly through the 1/2” pre-punched hole, directly behind the 2” vent stack hole in the center of the chamber ceiling.

Note Cover the open end of injection assembly with tape to keep insulation from entering the nipple. ▲

2. Slide 3/8” flatwasher over open end of nipple.
3. Insert the covered end of the injection assembly through the exterior hole.
4. Remove the tape covering from the end of the nipple and install the 1/8” NPT brass tee on the open end of the nipple. Place Permagum sealant between the brass tee and the interior top.
5. Remove the two Phillips head screws securing the metal bracket on the vent stack assembly.
6. Install the vent stack through the opening and secure it to the top of the freezer, using screws.

Install Vent Stack, Solenoid and Injection (continued)

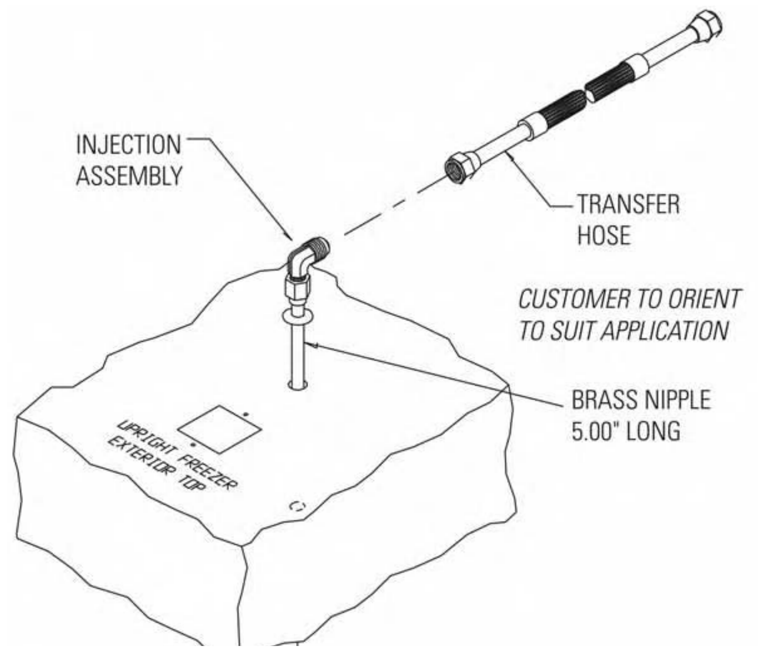


Figure 5-1. Injection Assembly

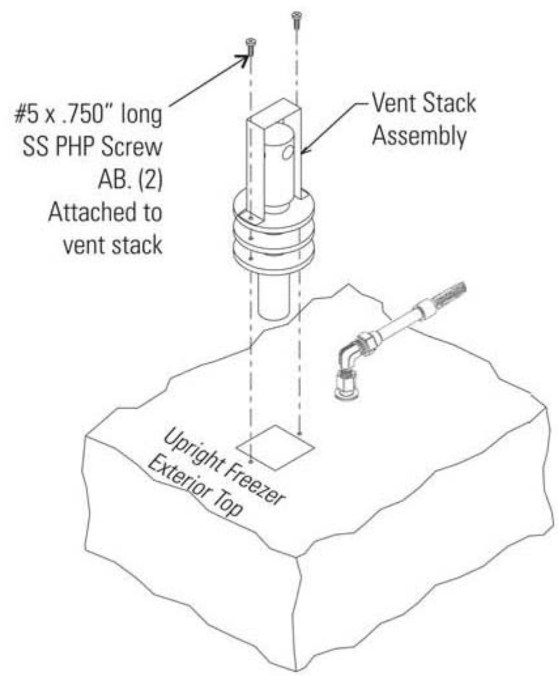


Figure 5-2. Vent Stack Assembly

Install Vent Stack, Solenoid and Injection (continued)

7. Inside the chamber, seal around the end of the vent stack with Permagum.

8. Install the transfer hose connecting one end to the injection assembly, the other to the solenoid valve. Connect the solenoid valve to the supply source. The solenoid mounting bracket may be discarded.

Note When selecting a CO_2 supply cylinder, it must be equipped with a siphon tube. ▲

Install Temperature Probe

1. Locate the 0.500" pre-punched hole in the upper left hand back corner of the chamber ceiling. Remove the tie wrap securing the coiled probe/solenoid harness. Uncoil the probe lead and run the probe tip (approximately 12") down through 0.500" porthole (Figure 5-4).

2. As shown in Figure 5-3, thread the small tie wrap through the openings in the front of the bracket. Secure the probe on the back of the bracket with the tie wrap.

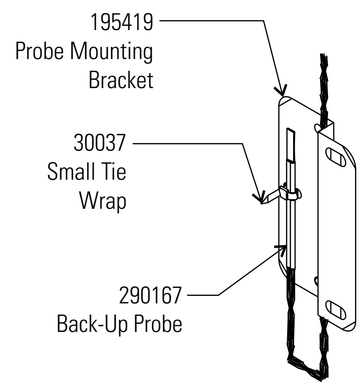


Figure 5-3. Secure probe

3. Tap #8-32 the two pre-punched holes located on the interior left wall of the freezer. Mount the bracket. Figure 5-4 shows the Back-Up probe mounted on the interior left side wall of the freezer.

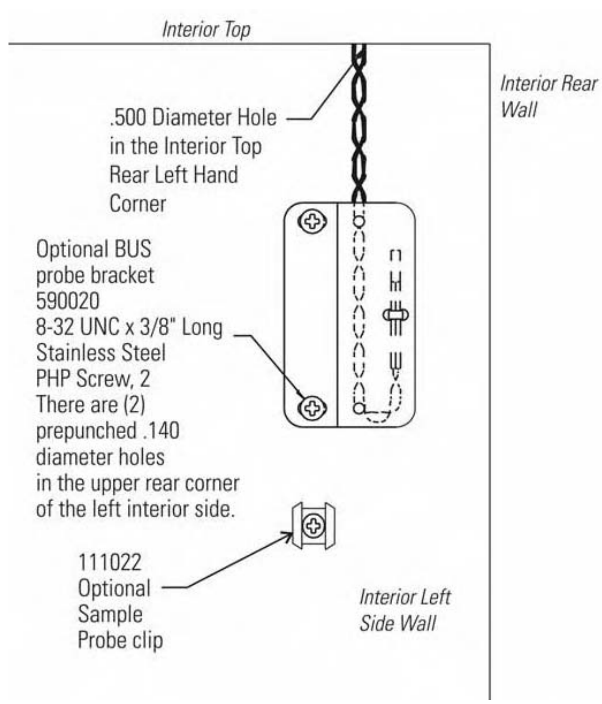


Figure 5-4. Mounted probe clip

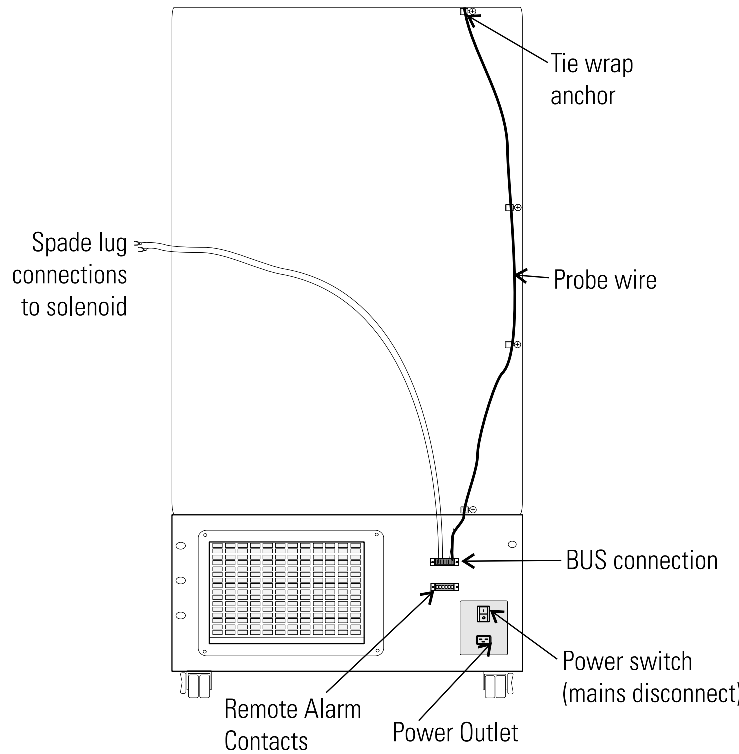


Figure 5-5. Probe wire and solenoid connections

Connect Probe/Solenoid Harness

1. Remove the four screws on the freezer back panel and use them to mount the tie wrap anchors as shown in Figure 5-5. Secure the probe wire with tie wraps.

2. Plug the solenoid/probe connector into the BUS connection and secure with a screw on the right and left side. The connector is keyed.

3. Loosen the terminal screws on the solenoid. Slide the spade lug connectors under the screws and tighten to secure.

4. Connect power to the freezer. Turn the freezer On, with battery switch Off (O).

    a. The Solenoid Engaged light on the BUS control panel will illuminate (no injection occurs). This light stays on until the unit is below BUS setpoint.

    b. The Low Battery indicator may also illuminate.

5. Turn the battery switch to Standby mode (⏻) to charge both batteries.

BUS Control Panel

The following section describes the configuration and operation of the BUS.

Warning When activated, this unit injects liquid nitrogen or carbon dioxide. Liquid nitrogen can cause serious freezing (frostbite) if it comes in contact with unprotected skin or eyes. Nitrogen suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to Appendix A for the proper handling of liquid LN_2. ▲

Caution Make sure the pressure relief valve on any LN_2 tank is adjusted to 30 PSI maximum blow-off. ▲

Warning Carbon dioxide gas suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to “Handling Liquid CO_2 in Appendix B of this manual. ▲

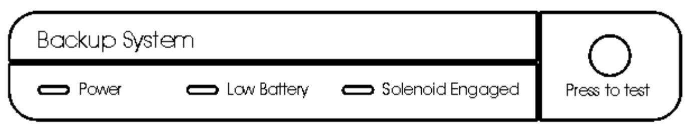


Figure 5-6. BUS Control Panel

Power - indicates the unit has AC power.

Low Battery - battery charge is low. The battery needs replaced or recharged.

Solenoid Engaged - BUS has opened the solenoid so it can inject gas (CO_2 or LN_2).

Press-To-Test - activates the solenoid and injects LN_2 or CO_2 into the freezer chamber as long as the button is depressed. The solenoid engaged indicator should light. If the Low Battery indicator lights during the test, replace the BUS battery.

Note Solenoid will not engage if door is open. ▲

Configure Optional BUS (Back-Up System)

The optional BUS can be configured for LN2 or CO2 supply. To select the supply type:

1. Press the Mode key until the Backup indicator lights.
2. Press the up or down arrow key. The display will show “cO2” or “Ln2” for selection.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to to RUN mode after 5 minutes.

Set Optional BUS Set Point

The optional back up system is designed to inject CO2 or LN2 into the freezer compartment if the temperature rises above back up system set point. To set the BUS set point:

1. Press the Mode key until the Set Temperature and Backup indicators light.
2. Press the up or down arrow key until the desired BUS set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to to RUN mode after 5 minutes.

Warning Changing the operating temperature set point can affect the BUS set point. The BUS set point will self-adjust to maintain a temperature of at least 10°C above the operating temperature set point. ▲

Note The BUS set point can not be set any colder than the high temperature alarm set point. (See Section 1 - “Setting the High Temperature Alarm). If the back-up system is installed with CO_2, then -65°C is the coldest BUS set point that can be used (if the cabinet set point is -75°C or colder). ▲

Test BUS Operation

After the freezer has stabilized and both batteries are fully charged, the BUS can be tested to verify proper operation.

1. Disconnect the AC power to the freezer by turning the power switch off.
2. As the freezer warms up, verify the BUS injects at the desired temperature. Displayed temperature may vary by a few degrees from inject temperature due to the differences in probe locations.

Clean Vent Stack

Routinely check the vent stack for frost or ice build-up. The type of frost that forms in the vent stack is generally very soft and may be easily removed with a bristle brush or soft cloth. If ice build-up has occurred, a complete defrost may occasionally be required. See Section 4 for freezer defrost instructions.

Disconnect Fitting Asm. and Transfer Hose

To disconnect the freezer back-up from the gas supply:

1. Close the supply valve.
2. Depress the test button on the BUS control box to remove the gas from the line.
3. Slowly disconnect the fitting assembly from the supply (in the event that any gas remains in the line).

Chart Recorder

The following section describes the set up and operation of the optional chart recorder.

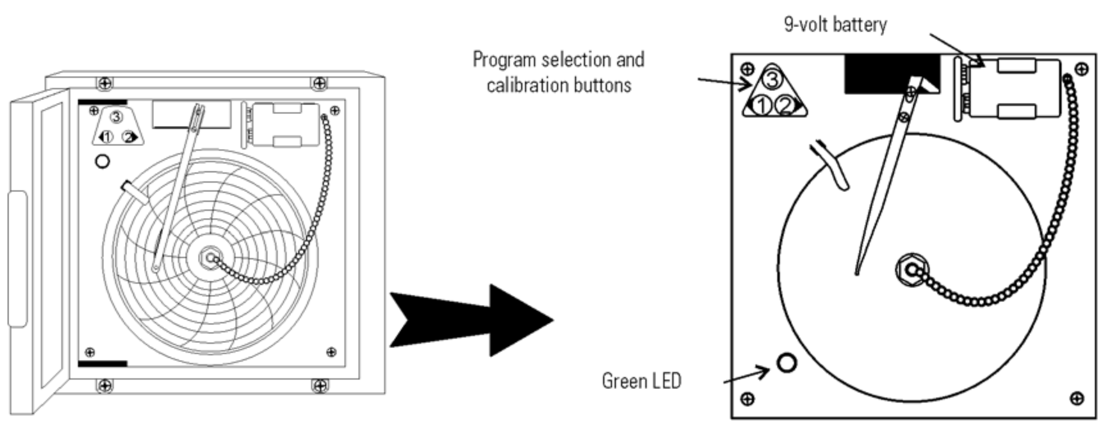


Figure 5-7. Recorder Details

Installing the Chart Paper

1. Open the plastic door of the recorder and press button #3 until the pen begins to move outward.
2. Unscrew the knob at the center of the chart and remove the paper.
3. Install the new chart paper, position the paper to the correct time line and replace the knob.
4. Remove the cap from the felt pen and press button #3.

Change Recorder Temperature Range

The chart recorder contains eight factory programmed temperature ranges. To change the recorder range:

Program	From	To
1	-40	30°C
2	0	60°C
3	-100	38°C
4	-5	50°C
5	0	100°C
6	-100	200°C
7	-115	50°C
8	-10	70°C

1. Press and hold button #3 for one second, then let the pen move off the chart paper.
2. Press and hold for five seconds either button #1 or button #2.
3. Release button and the green LED begins to flash. Count the number of flashes to determine the present program setting.
4. To change the program setting, press the left or right arrows to increase or decrease the count.
5. When the desired program number is flashing, press button #3 to bring the pen arm back onto the chart. Recording will begin in the new program.

Recorder Calibration

Note The recorder must be in service for 24 hours before performing the following calibration procedure. ▲

1. Place an accurate thermometer in the chamber next to the recorder probe. Temperature probes for the recorder are located in the left front corner of the freezer chamber (Figure 1-4).
2. After about three minutes, compare the thermometer reading with the chart recorder reading.
3. If an adjustment is necessary, press the #1 button to move the pen to the left or the #2 to move the pen to the right. The button must be held about five seconds before the pen begins to move. Release the button when the pen position matches the thermometer.

Note The felt-tip pen on the recorder requires periodic replacement. The ink will appear to fade before replacement becomes necessary. Additional pen tips may be purchased from Thermo. ▲

Datalogger

Dataloggers and ELPRO evaluation software provide monitoring and documentation of temperature and alarm conditions. The dataloggers have a memory capacity of 64,000 measured values or data points. Temperature is measured, stored and displayed. Alarm conditions are recorded. Evaluation software permits data to be downloaded to a PC. A variety of statistical information is provided through calculations, analysis, graphs and printed reports. Refer to the ELPRO documentation for operating instructions for the datalogger.

Water-cooled Condenser

The water-cooled condenser is a factory installed option (195964 [13 cu ft], 195965 [17, 23, 28 cu ft], 195967 [12, 17, 20 cu ft chest]) and requires a qualified technician at freezer installation. Installation should include proper adjustment of the regulating valve, which controls the discharge pressure. Refer to Table 5-1 for the specifications for this option.

Table 5-1. Water-Cooled Condenser Specifications

Water Source	Tower	City
Water Pressure	Not to exceed 150 psig	
Water Temperature Range	Not to exceed 29.4C (85F)	
Inlet Connection	0.5″ compression	
Outlet Connection	0.5″ compression	
Flow Rate Required	3.0 gallons (11.4 liters) per minute	1.0 gallon (3.8 liters) per minute
Drain Required	No (return line is required)	Yes

Five Inner Door Option

The five inner door option (P/N 189405 [13 cu ft], 189406 [17 cu ft], 189407 [23 cu ft], 195652 [28 cu ft]) is factory installed. The freezer is converted to accommodate four adjustable specimen shelves with the fifth “shelf” as the bottom of the freezer chamber.

Section 6 Specifications

Number (Model)	TSE240V (933)	TSE240D (947)	TSE240A (930)
Temperature Range	-50°C (-58°F) to -86°C (-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient		
Exterior Dimensions	33.3”W x 77.9” H x 32.9” F-B (84.6cm x 197.9cm x 83.6cm)		
Interior Dimensions	23.0”W x 51.5”H x 19.3” F-B (58.4cm x 130.8cm x 49.0cm)		
Capacity	13.0 cu. ft. (368.1 liters)		
Refrigeration	Two 1 HP (2545 BTUH each)		
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 4.5” (11.4 cm) door		
Electrical	230VAC, 50 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	230VAC, 60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC
Breaker Requirements	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	20 Amp, Dedicated Circuit, 20 Amp Time Delay Breaker
Shipping Weight	696 lbs. (316 kg)		

Number (Model)	TSE320A (931)	TSE320V (935)	TSE320D (948)
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient		
Exterior Dimensions	33.3”W x 77.9” H x 38.9” F-B (84.6cm x 197.9cm x 94.0cm)		
Interior Dimensions	23.0”W x 51.5”H x 25.3” F-B (58.4cm x 130.8cm x 64.3cm)		
Capacity	17.3 cu. ft. (489.9 liters)		
Refrigeration	Two 1 HP (2545 BTUH each)		
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 4.5” (11.4 cm) door		
Electrical	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC	230VAC, 50 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	230VAC, 60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC
Breaker Requirements	20 Amp, Dedicated Circuit, 20 Amp Time Delay Breaker	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight	763 lbs. (346 kg)		

Number (Model)	TSE400V (936)	TSE400D (949)	TSE400A (932)
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient		
Exterior Dimensions	40.8"W x 77.9" H x 38.9" F-B (103.6cm x 197.9cm x 94.0cm)		
Interior Dimensions	30.6"W x 51.5"H x 25.3" F-B (77.7cm x 130.8cm x 64.3cm)		
Capacity	23.0 cu. ft. (651.3 liters)		
Refrigeration	Two 1 HP (2545 BTUH each)		
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 4.5" (11.4 cm) door		
Electrical	230VAC, 50 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	230VAC, 60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC
Breaker Requirements	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	20 Amp, Dedicated Circuit, 20 Amp Time Delay Breaker
Shipping Weight	900 lbs. (408 kg)		

Number (Model)	TSE600V (950)	TSE600D (937)
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	46.8"W x 77.9" H x 38.9" F-B (118.9cm x 197.9cm x 94.0cm)	
Interior Dimensions	36.6"W x 51.5"H x 27.0" F-B (93.0cm x 130.8cm x 68.6cm)	
Capacity	28.0 cu. ft. (792,8 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 4.5" (11.4 cm) door	
Electrical	230VAC, 50 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	230VAC, 60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC
Breaker Requirements	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight	1070 lbs. (485 kg)	

Certifications

Declaration of Conformity is available from the factory

Safety Specifications

Indoor Use Only
Altitude - up to 2,000 meters
Temperature - 5°C to 43°C
Humidity - Maximum RH 80% for temperatures up to 31°C, decreasing linearly to 50% RH at 40°C
Mains Supply Fluctuations - Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage
Installation Category II [1]
Pollution Degree 2 [2]
Class of Equipment I

Intended Use

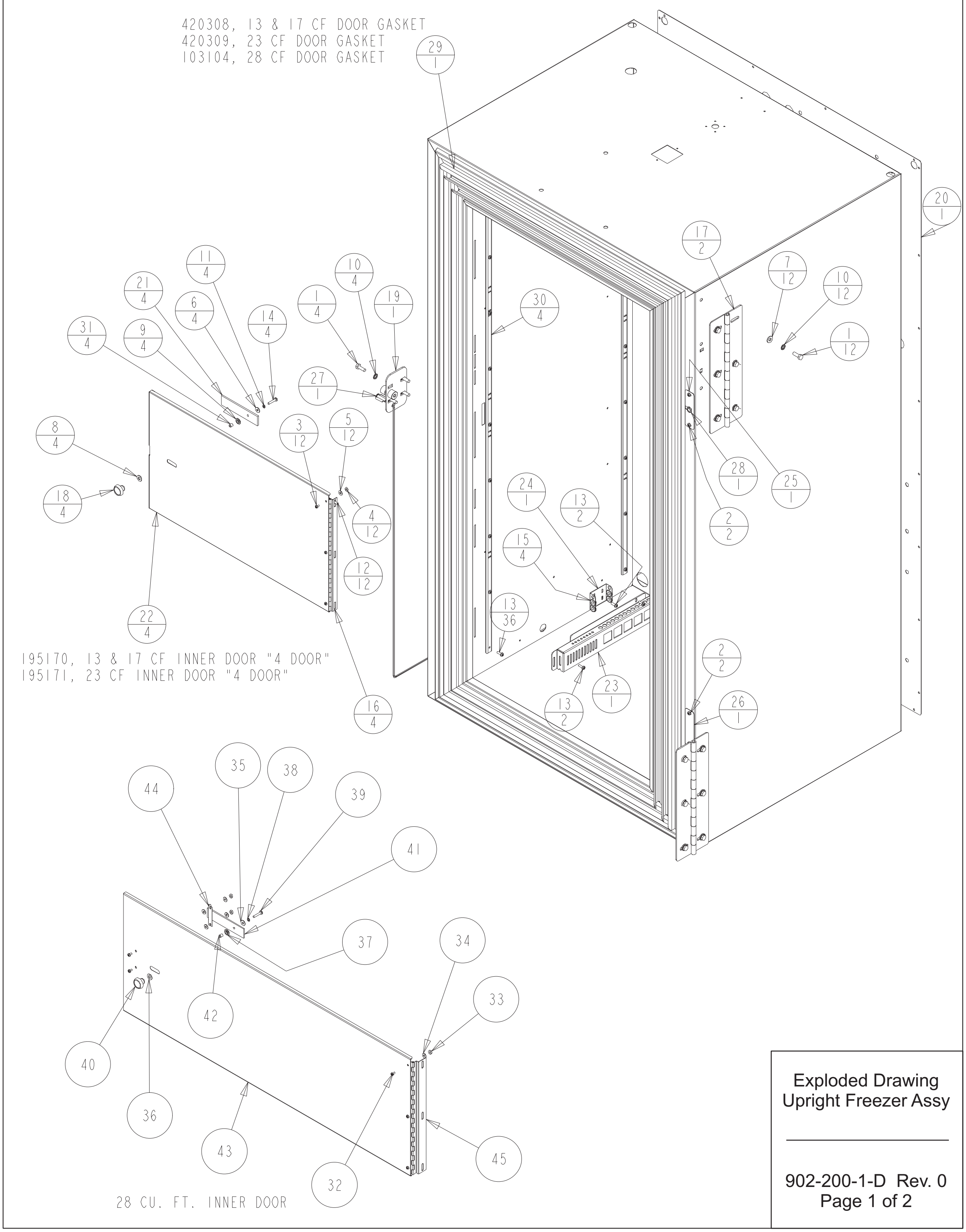
This product is intended for use as a General Purpose Laboratory Freezer for storing samples or inventory between -40 and -86C.

This unit is not intended for use in an explosive environment, nor to be used for the storage of flammable inventory. This unit is not intended for use in a Class II medical application as defined by Title 21 of the Federal Code of Regulations.

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1 Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

2 Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.



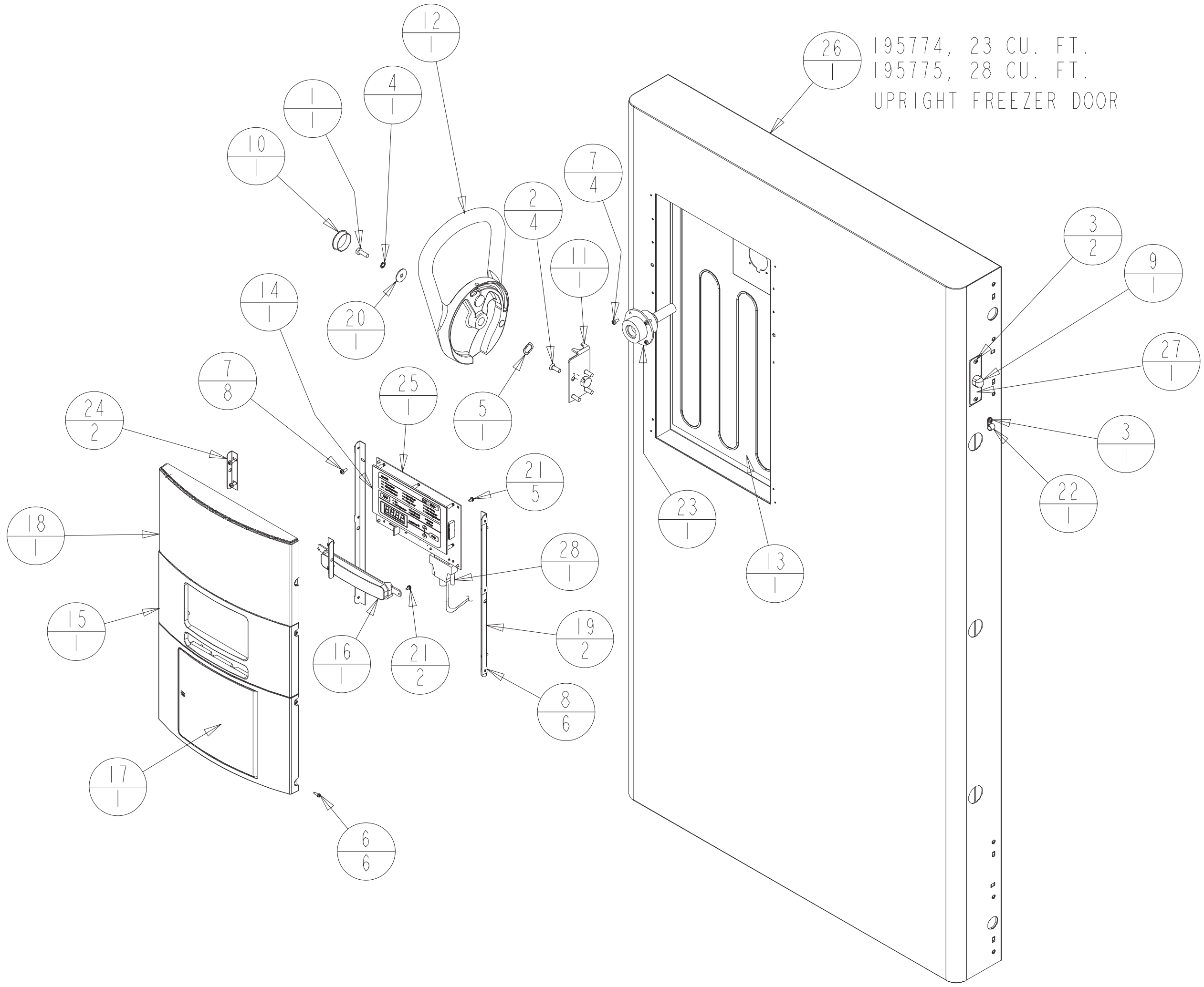
Exploded Drawing
Upright Freezer Assy

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BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	20003	1/4-20 X 3/4 SS HH CAP SCREW
2	22053	#8-32 X 1/2 SS PHP SCREW
3	22115	#6-32 X 1/4 SS PHP SCREW
4	23009	#6-32 SS HEX NUT
5	23020	#6 SS FLAT WASHER
6	23021	#8 SS FLAT WASHER
7	23023	1/4 SS FLAT WASHER
8	23043	NYLON FLAT WASHER
9	23044	1/4" NYLON SHOULDER WASHER
10	23062	1/4 SS EXT TOOTH LOCKWASHER
11	23080	#8 SS SPRING LOCKWASHER
12	24032	#8-32 X 3/8 SS PHP SCREW F POINT
13	24042	#8-32 X 1/2 SS PHP SCREW F POINT
14	59008	#8-32 X 7/8 SS PHP SCREW
15	114020	5/8" X 1/2" ID GROMMET
16	116077	FRONT PANEL HINGE
17	116092	EXTERIOR FREEZER DOOR HINGE
18	120400	BLACK PLASTIC KNOB
19	121069	FREEZER CAM LATCH STRIKE
20	189921	EXTERIOR BACK 13 & 17
21	195169	LATCH TAB
22	195170	13/17 CU. FT. INNER DOOR
23	195866	PROBE GUARD
24	195867	PROBE MOUNT
25	195874	CABINET CABLE COVER PLATE
26	195879	CABINET CABLE BLANK COVER PLATE
27	195900	SINGLE DOOR SWITCH ASSY.
28	330010	1/2" SPLIT SNAP BUSHING
29	420308	13 & 17 CU. FT. SINGLE DOOR FRAME GASKET
30	500177	PILSATER STRIPS
31	515083	1/4 DIA. X 1/4L SS SPACER
32	22115	#6-32 X 1/4 SS PHP SCREW
33	23009	#6-32 SS HEX NUT
34	23020	#6 SS FLAT WASHER
35	23021	#8 SS FLAT WASHER
36	23043	NYLON FLAT WASHER
37	23044	1/4" NYLON SHOULDER WASHER
38	23080	#8 SS SPRING LOCKWASHER
39	59008	#8-32 X 7/8 SS PHP SCREW
40	120400	BLACK PLASTIC KNOB
41	195169	LATCH TAB
42	515083	1/4 DIA. X 1/4L SS SPACER
43	1950217	28 CU. FT. INNER DOOR
44	1950218	28 CU. FT. INNER DOOR LATCH GUIDE
45	116090	FRONT PANEL HINGE

Exploded Drawing
Upright Freezer Assy

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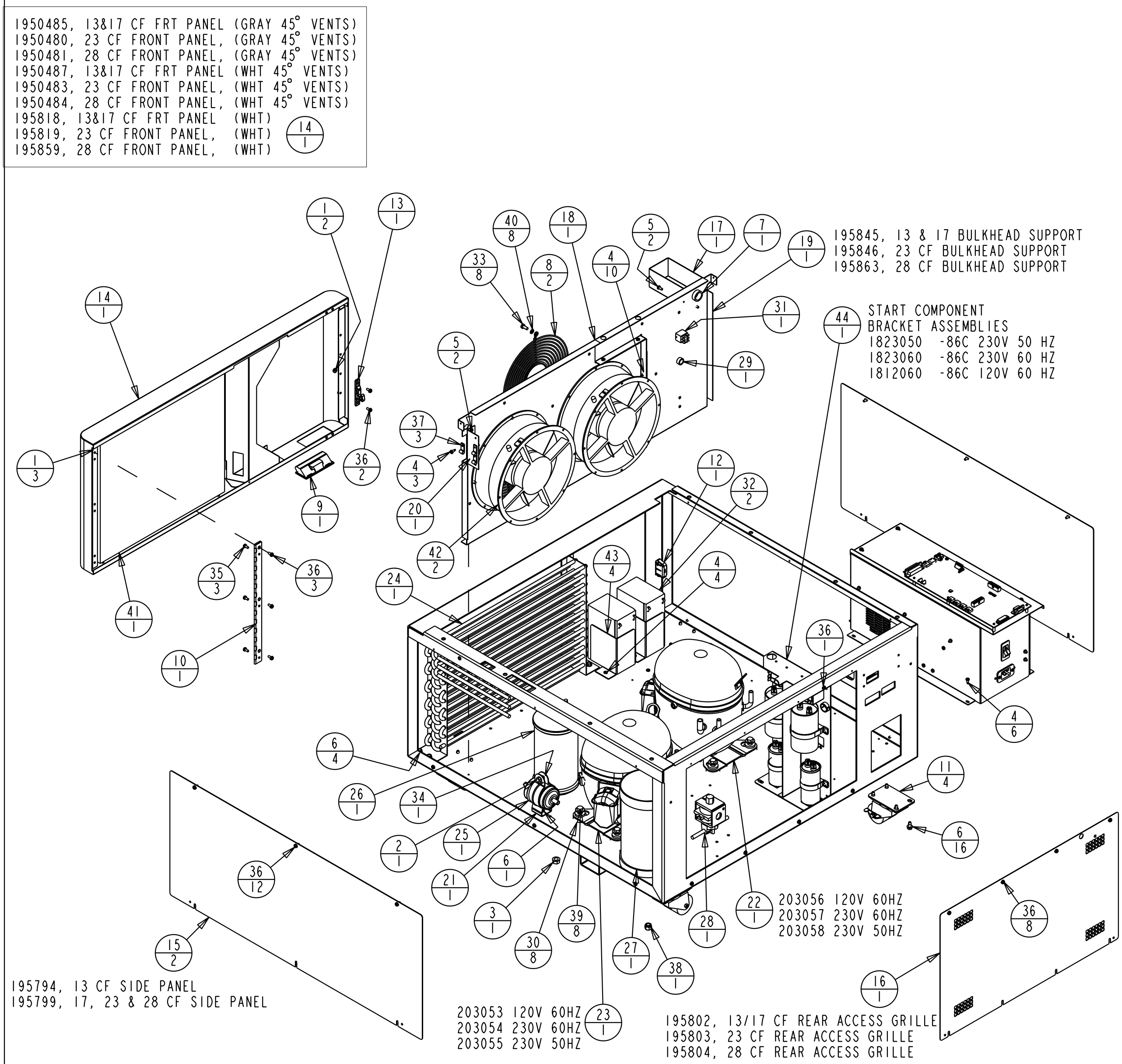
Exploded Drawing
Single Door Assy
Upright Freezer

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BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	20003	1/4-20 X 3/4 SS HH CAP SCREW
2	20058	#1/4-20 X 3/4 SS FHP UC SCREW
3	22053	#8-32 X 1/2 SS PHP SCREW
4	23033	1/4 SS INTERNAL TOOTH LOCK WASHER
5	23057	5/8 WAVE WASHER
6	24016	#6 X 1/2" SS PHP SCREW AB POINT
7	24032	#8-32 X 3/8 SS PHP SCREW F POINT
8	25040	#6 U SPEED NUT STL. STL.
9	30033	RIGHT ANGLE STRAIN RELIEF
10	117051	1-3/8" DIA. 646 SID BLUE HOLE PLUG
11	121075	CAM LATCH MOUNT
12	121089	FINISHED HANDLE/LATCH ASSEMBLY "SID BLU"
13	132114	HEATER, 3W, 14VDC
14	140291	CONTROL PANEL ASSEMBLY
15	180305	CONTROL CENTER DISPLAY BEZEL "SID BLU"
16	180306	THERMO BACK-UP SYSTEM BLANK PANEL "SID BLUE"
17	180308	CONTROL CENTER RECORDER BLANK "SID BLU"
18	180360	CONTROL BLANK PANEL "SID BLUE"
19	195837	MOUNTING ANGLE FOR 180305
20	510305	1" OD FLAT WASHER
21	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
22	600085	5/16 NYLON CABLE CLAMP
23	1950069	HEATED VACUUM RELIEF PORT
24	1950492	MOUNTING ANGLE
25	191956_	FREEZER DISPLAY BOARD
26	195773	13 &17 CU. FT. UPRIGHT FREEZER DOOR
27	195830	UPRIGHT DOOR WIREWAY COVER PLATE
28	430336	15 FT, RS-232 CABLE 25 POS.

Exploded Drawing
Single Door Assy
Upright Freezer

902-201-1-B Rev. 5
Page 2 of 2



Exploded Drawing
Upright Freezer
Base Assembly
(F - TS - R - I -86C)

902-203-1-D Rev. 1
Page 1 of 2

BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESCRIPTION
1	23002	#8-32 ZP LKWASH HEX NUT
2	23011	1/4-20 ZP LKWASH HEX NUT
3	23013	3/8-16 ZP LKWASH HEX NUT
4	24030	#8 X 1/2" TEKS SCREW
5	24032	#8-32 X 3/8 SS PHP SCREW F POINT
6	24038	1/4-20 X 1/2 SELF TAPPING SCREW
7	30016	1" SNAP BUSHING
8	108020	10" WIRE FAN GUARD
9	115032	BLACK ABS PLASTIC PULL
10	116115	FRONT PANEL HINGE
11	120011	DUAL WHEEL CASTER
12	121071	LATCH CATCH, PART OF 121071 ASSEMBLY
13	121071	LATCH KEEPER, PART OF 121071 ASSEMBLY
14	195746	13&17 CU. FT. UR FRZ BASE FRONT PNL
15	195799	SIDE PANEL 17, 23 AND 28 CU. FT. UPRIGHT
16	195802	13/17 REAR ACCESS GRILLE
17	195829	MULLION/DOOR SWITCH WIRE COVER
18	195844	UR FRZ FAN BULKHEAD
19	195845	13&17 CU. FT. FAN BULKHEAD SUPPORT
20	195882	REFRIGERATION LINE SUPPORT BRACKET
21	200126	2" RIGID HANGER
22	203054	HIGH STG UPRIGHT COMPRESSOR 230V 60HZ
23	203057	LOW STG UPRIGHT COMPRESSOR 230V 60HZ
24	204009	REFRIGERATION CONDENSER
25	209020	LIQUID LINE FILTER DRYER WITH ACCESS PORT
26	214006	OIL SEPARATOR
27	214018	10.000" H X 5.000" DIA. EXPANSION TANK
28	220626	120V - 50/60 HZ SOLENOID VALVE
29	330002	5/8" SNAP BUSHING
30	350096	RUBBER MOUNT FOOT EMBRACO
31	360248	MINI SNAP-IN POWER SWITCH
32	400159	SEALED LEAD ACID BATTERY - 12 VOLT - 7.2 Ah
33	510035	#12-24 X 1/2 SS HH CAP SCREW
34	550043	1/4-20 X 1"L ZP CARRIAGE BOLT
35	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
36	590029	#8-32 X 3/8 SS PHP EXT SEMS SCREW W/PATCH
37	600080	1/4 ALUM CLAMP W/LINER
38	610053	3/8-16 NYLON INSERT LOCK NUT
39	680030	5/16-18 X 1.75 SS HH SHOULDER BOLT
40	730087	#12 SS EXT TOOTH LOCKWASHER
41	760203	AIR FILTER
42	900113	10" TUBEAXIAL FAN, 115V
43	1950074	BATTERY MOUNTING BRACKET
44	120230-01-2	URIGHT FREEZER START COMPONENT BRACKET ASSY.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	FR-2202	06-15-11	KDG	KDG	DRP	RELEASED FOR PRODUCTION/LIB.CAP
1	FR-2267	11-21-11	JWE	KDG	CCS	COMPRESSOR CHANGE, RELEASE 7

Thermo Fisher SCIENTIFIC

BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME: UP-RIGHT FREEZER

DWG TITLE: UP-RIGHT FREEZER ASSEMBLY (F-TS-R-H-1-86)

DWN: KDG	CAD: KDG	APPD: DRP	DATE: 06-15-11	SCALE: 0.094

MATERIAL: N/A

PAINT: N/A

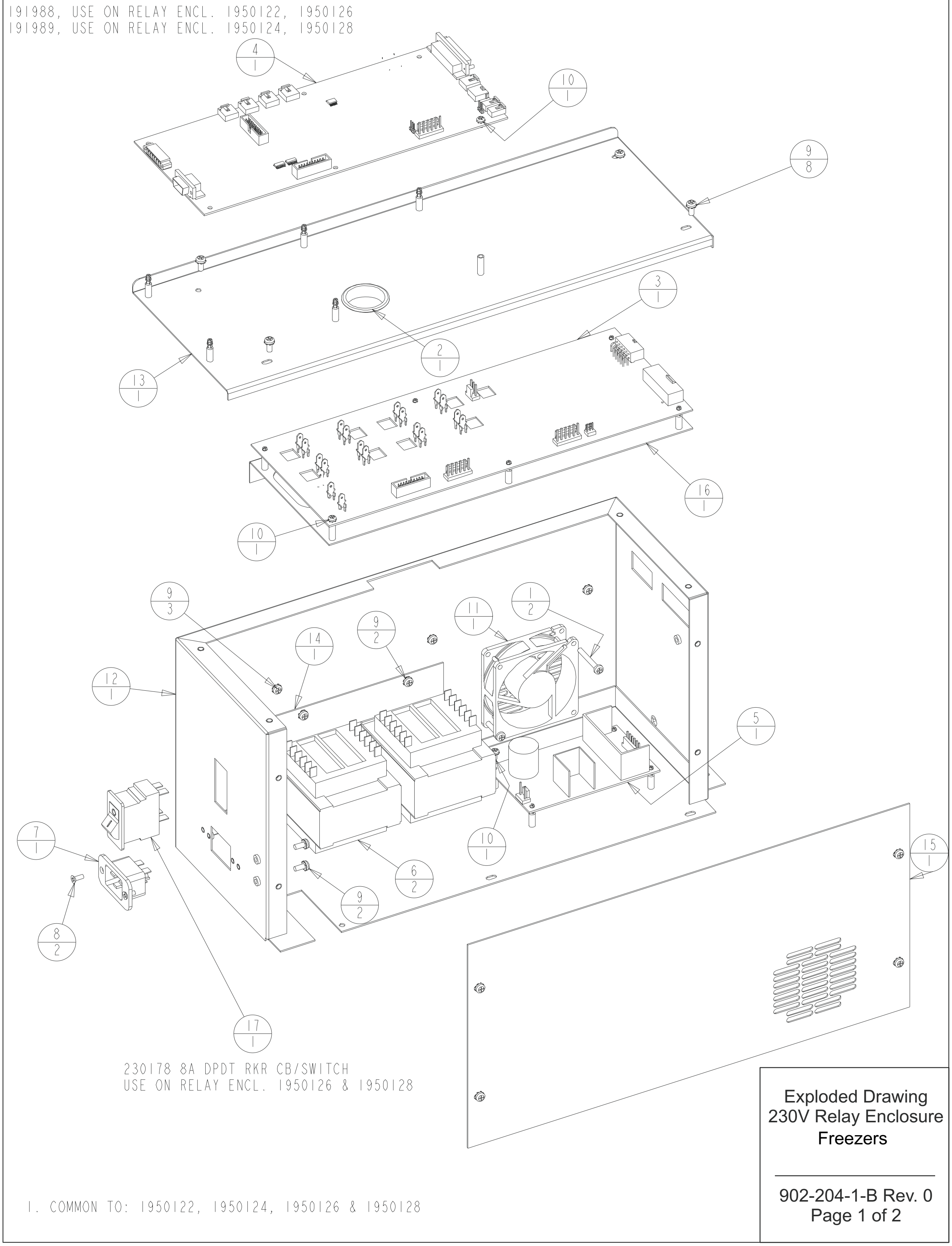
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±

DRAWING NUMBER: 902-203-1

SIZE: B

Exploded Drawing
Upright Freezer
Base Assembly
(F - TS - R - I -86C)

902-203-1-D Rev. 1
Page 2 of 2



Exploded Drawing
230V Relay Enclosure
Freezers

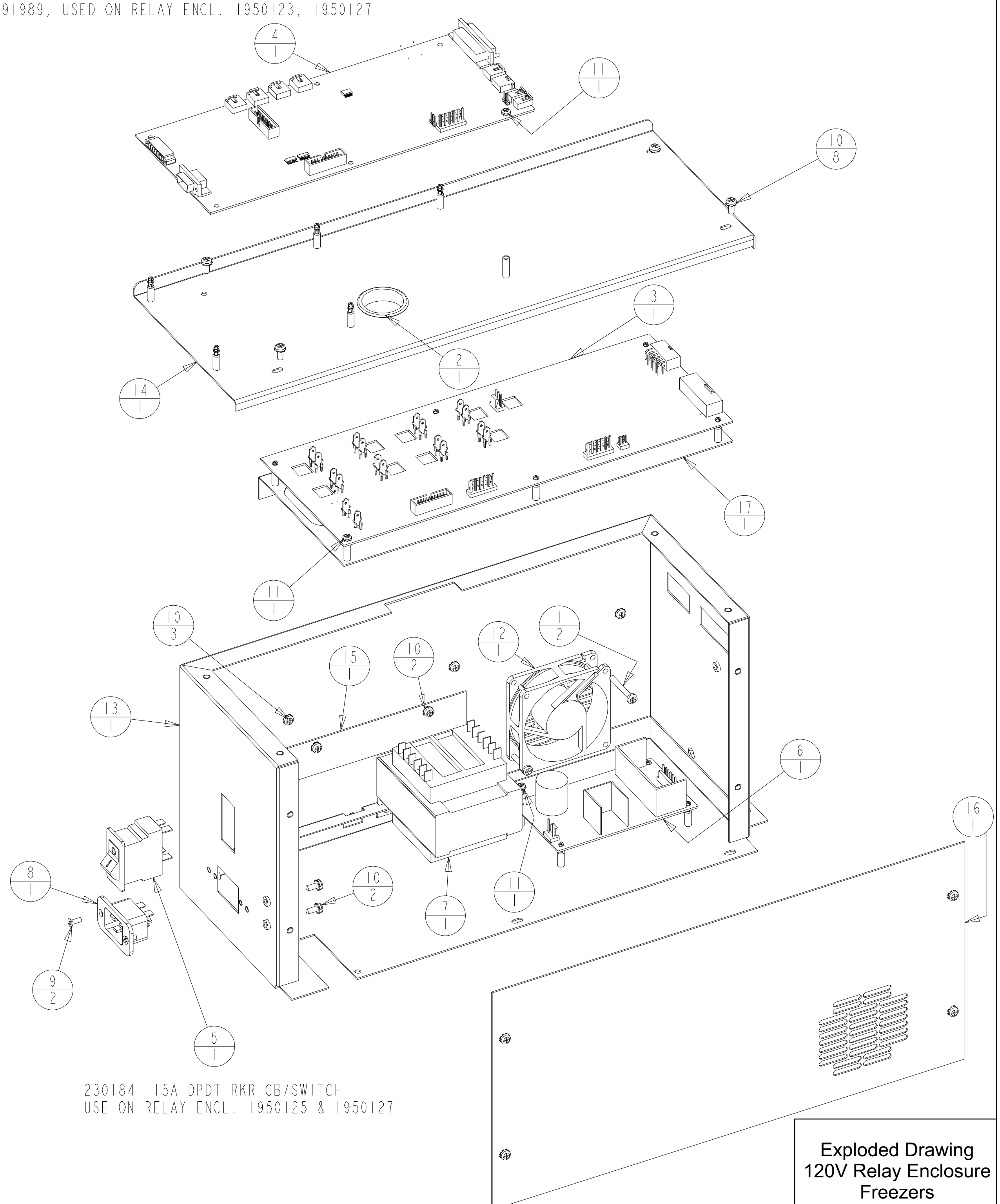
902-204-1-B Rev. 0
Page 1 of 2

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	22143	#8-32 x 1-1/4 SS PHP SCREW
2	30077	1-1/2" SNAP BUSHING
3	191923	HIGH VOLTAGE BOARD 230V
4	191988	MICRO BOARD (LOW END)
5	400165	SWITCHER BOARD
6	420090	175V TRANSFORMER
7	460169	POWER INLET, 16/20A
8	490009	#6-32 X 3/8 SS FHP UC SCREW
9	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
10	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
11	900134	TUBEAXIAL FAN, 30 CFM, 12V
12	195631-16-1	RELAY ENCLOSURE SPOTWELD SUB-ASSEMBLY
13	195631-16-4	RELAY ENCLOSURE COVER/191656 SUPPORT
14	195631-31-3	TRANSFORMER HOLD DOWN
15	195631-31-5	RELAY ENCLOSURE COVER (MAIN)
16	195730-16-1	191658 SUPPORT BRACKET SUB-ASSEMBLY
17	230184	15A DPDT SWITCH/CIRCUIT BKR

Exploded Drawing
230V Relay Enclosure
Freezers

902-204-1-B Rev. 0
Page 2 of 2

191988, USED ON RELAY ENCL. 1950121, 1950125
191989, USED ON RELAY ENCL. 1950123, 1950127



230184 15A DPDT RKR CB/SWITCH
USE ON RELAY ENCL. 1950125 & 1950127

1. COMMON TO: 1950121, 1950123, 1950125 & 1950127

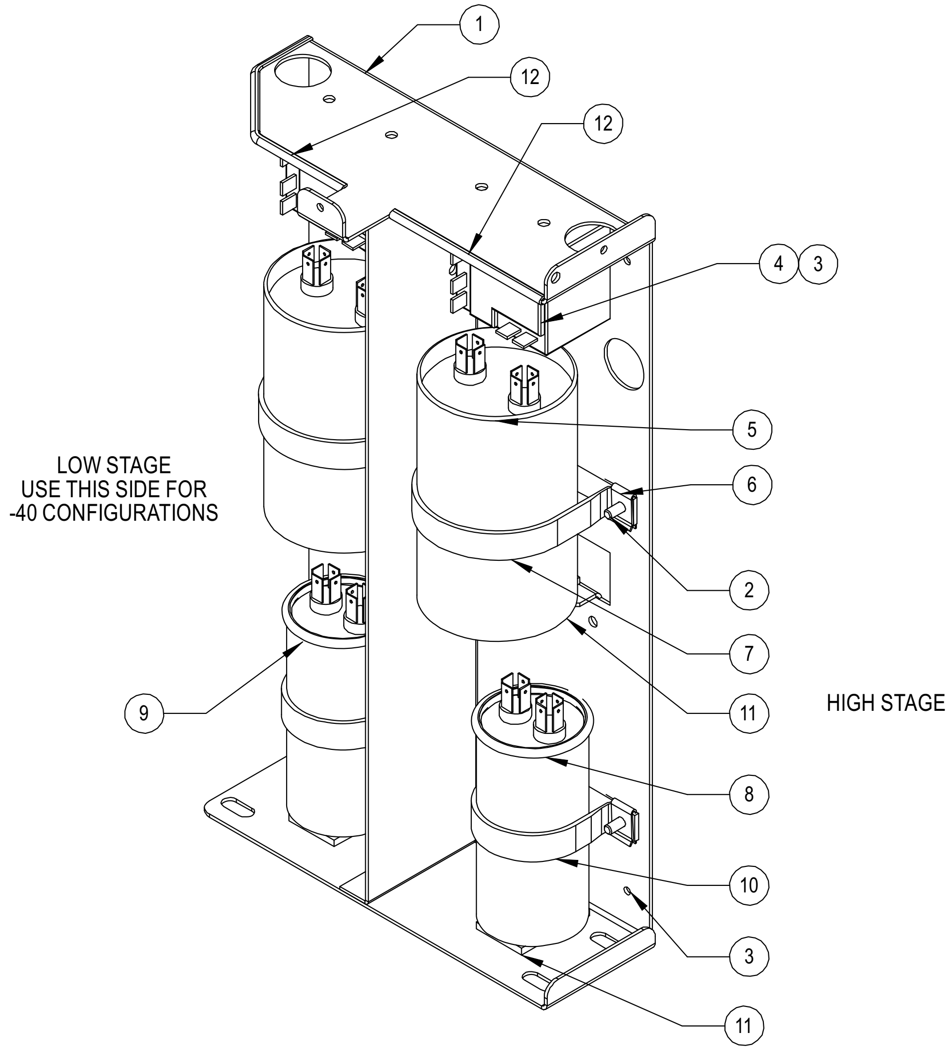
Exploded Drawing
120V Relay Enclosure
Freezers

902-204-2-B Rev. 0
Page 1 of 2

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	22143	#8-32 x 1-1/4 SS PHP SCREW
2	30077	1-1/2" SNAP BUSHING
3	191932	HIGH VOLTAGE BOARD 120V
4	191988	MICRO BOARD (LOW END)
5	230183	20A DPDT SWITCH/CIRCUIT BKR
6	400165	SWITCHER BOARD
7	420065	175V TRANSFORMER
8	460169	POWER INLET, 16/20A
9	490009	#6-32 X 3/8 SS FHP UC SCREW
10	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
11	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
12	900134	TUBEAXIAL FAN, 30 CFM, 12V
13	195631-16-1	RELAY ENCLOSURE SPOTWELD SUB-ASSEMBLY
14	195631-16-4	RELAY ENCLOSURE COVER/191656 SUPPORT
15	195631-31-3	TRANSFORMER HOLD DOWN
16	195631-31-5	RELAY ENCLOSURE COVER (MAIN)
17	195730-16-1	191658 SUPPORT BRACKET SUB-ASSEMBLY

Exploded Drawing
120V Relay Enclosure
Freezers

902-204-2-B Rev. 0
Page 2 of 2



NOTES:

1. SEE PSS 8602-724-012 FOR ASSEMBLY WIRING AND OTHER DETAILS.
2. AFTER ATTACHING NOMEX COVER (250138) WITH SCREWS (590029), STICK ESD LABEL (220555) TO OUTSIDE OF COVER.
3. IDENTIFY EACH ASSEMBLY WITH LABELS ON THE BOTTOM AND BACK THAT INCLUDE THE FOLLOWING:
   FIRST LINE - ASSEMBLY NUMBER AND REVISION
   SECOND LINE - BAR CODE OF ASSEMBLY AND REVISION
   THIRD LINE - UNIQUE SERIAL NUMBER INCLUDING DATE OF MANUFACTURE IN THE FOLLOWING FORMAT AND ORDER: THREE LETTER MANUFACTURING SITE, TWO DIGIT YEAR MANUFACTURED, TWO DIGIT WEEK MANUFACTURED FOLLOWED BY A UNIQUE FOUR DIGIT NUMBER.
   FOURTH LINE - BAR CODE OF UNIQUE SERIAL NUMBER.
   FIFTH LINE - ASSEMBLY DESCRIPTION IN THE FOLLOWING FORMAT: UPRIGHT, TEMPERATURE, VOLTAGE AND FREQUENCY.

Exploded Drawing
Start Component
Enclosure Assembly
Upright Freezer

120230-10-2-B Rev. 4
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	FR-2267	11-23-11	SAG	SAG	DRP	RELEASED FOR PRODUCTION
1	FR-2267	01-30-12	JWE	SAG	DRP	UPDATED PARTS LIST AND NOTE
2	FR-2267	02-23-12	JWE	SAG	DRP	REPLACED PTCR WITH HARD START COMPONENTS
3	FR-2310	03-15-12	AJC	SAG	DRP	ADDED EDGE GUARD, MADE HARDWARE CHANGES
4	FR-2361	05-08-12	MAM	KDG	CCS	CHG. LOW STAGE RUN CAP FOR 1823060 CONFIG.

UPRIGHT FREEZER START COMPONENT BRACKET ASSEMBLIES

	ITEM NO.	DESCRIPTION	**1823050 -86C 230V 50 Hz**	**1823060 -86C 230V 60 Hz**	**1812060 -86C 120V 60 Hz**	**1423050 -40C 230V 50 Hz**	**1423060 -40C 230V 60 Hz**	**1412060 -40C 120V 60 Hz**
	1	COMPONENT BRACKET	120230	120230	120230	120230	120230	120230
	2	#8 X 1/2 PHP TYPE AB	24021 (4)	24021 (4)	24021 (4)	24021 (2)	24021(2)	24021 (2)
	3	8-32 X 3/8 SCREW	590020 (4)	590020 (4)	590020 (4)	590020 (2)	590020 (2)	590020 (2)
	4	START RELAY	523050 (2)	523060 (2)	512060 (2)	523050 (1)	523060 (1)	512060 (1)
	5	START CAPACITOR	623050 (2)	623060 (2)	612060 (2)	623050 (1)	623060 (1)	612060 (1)
	6	#8 SPEED NUT, S.S.	327675 (4)	327675 (4)	327675 (4)	327675 (2)	327675 (2)	327675 (2)
	7A	2.5" VINYL COATED STRAP	N/A	N/A	600106 (4)	N/A	N/A	600106 (2)
	7B	2" VINYL COATED STRAP	600108 (2)	600108 (2)	N/A	600108 (1)	600108 (1)	N/A
	8	RUN CAPACITOR	223050	223060	212060	N/A	N/A	N/A
	9	RUN CAPACITOR	223050	223050	212060	223050 (1)	223060 (1)	212060 (1)
	10	1.75" VINYL COATED STRAP	600107 (2)	600107 (2)	SEE 7A	600107 (1)	600107 (1)	SEE 7A
	11	NEOPRENE TAPE 1/8" X 1" X 2"	28003 (4)	28003 (4)	28003 (4)	28003 (2)	28003 (2)	28003 (2)
	12	EDGE GUARD (CUT TO LENGTH)	114012	114012	114012	114012	114012	114012
NOT SHOWN *	13	ULT MAIN HARNESS (REFERENCE ONLY)	350092	350092	350092	350093	350093	350093
NOT SHOWN	14	ENCLOSURE LOW STAGE HARNESS	350108	350108	350108	350108	350108	350108
NOT SHOWN	15	ENCLOSURE HIGH STAGE HARNESS	350107	350107	350107	N/A	N/A	N/A
NOT SHOWN	16	NOMEX COVER	250138	250138	250138	250138	250138	250138
NOT SHOWN	17	ESD WARNING LABEL	220555 (2)	220555 (2)	220555 (2)	220555 (2)	220555 (2)	220555 (2)
NOT SHOWN, SEE NOTE 3	18	IDENTIFICATION LABEL	823050 (2)	823060 (2)	812060 (2)	423050 (2)	423060 (2)	412060 (2)

* THE ULT MAIN HARNESS IS LISTED FOR INFORMATION ONLY. IT IS NOT PART OF THIS ASSEMBLY.

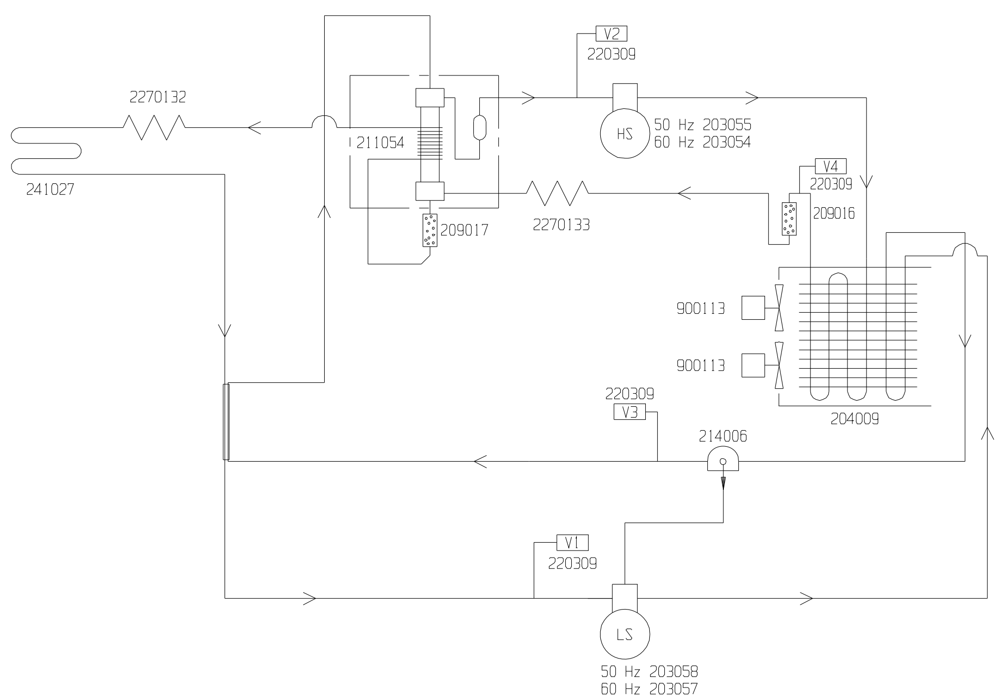
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME: UPRIGHT FREEZER START COMPONENT ENCLOSURE ASSEMBY					
DWG TITLE: UPRIGHT FREEZER START COMPONENT ENCLOSURE ASSEMBLY					
DWN: SAG	CAD: SAG	APPD: DRP	DATE: 11/16/11	SCALE: 1:4	
MATERIAL: SEE TABLE					
PAINT COLOR: N/A					
TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES: DECIMAL: .XX=± .XXX=±			DRAWING NUMBER 120230-01-2		SIZE B

Exploded Drawing
Start Component
Enclosure Assembly
Upright Freezer

120230-10-2-B Rev. 4
Page 2 of 2

HIGH TEMP STAGE



LOW TEMP STAGE

CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

13 CUFT 50 Hz UNITS: R-404A 23 OZ. (652g) ±1/2 OZ (14g)
13 CUFT 60 Hz UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL COMPRESSOR, 22 OZ. (651ml)

LOW TEMPERATURE STAGE REFRIGERANT:

13 CUFT 50 Hz UNITS: R-290 0.5 OZ. (14g) MAX, ; VAC TO 20"
R-508B 12.0 OZ (340g) ± 1/4 OZ. (7g) OR
20" TO 145 PSIG ± 3 PSIG

13 CUFT 60 Hz UNITS: R-290 0.5 OZ. (14g) MAX, ; VAC TO 20"
R-508B 14.0 OZ (397g) ± 1/4 OZ. (7g) OR
20" TO 159 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ. (651ml)
OIL SEPARATOR: 15 OZ. (444ml)

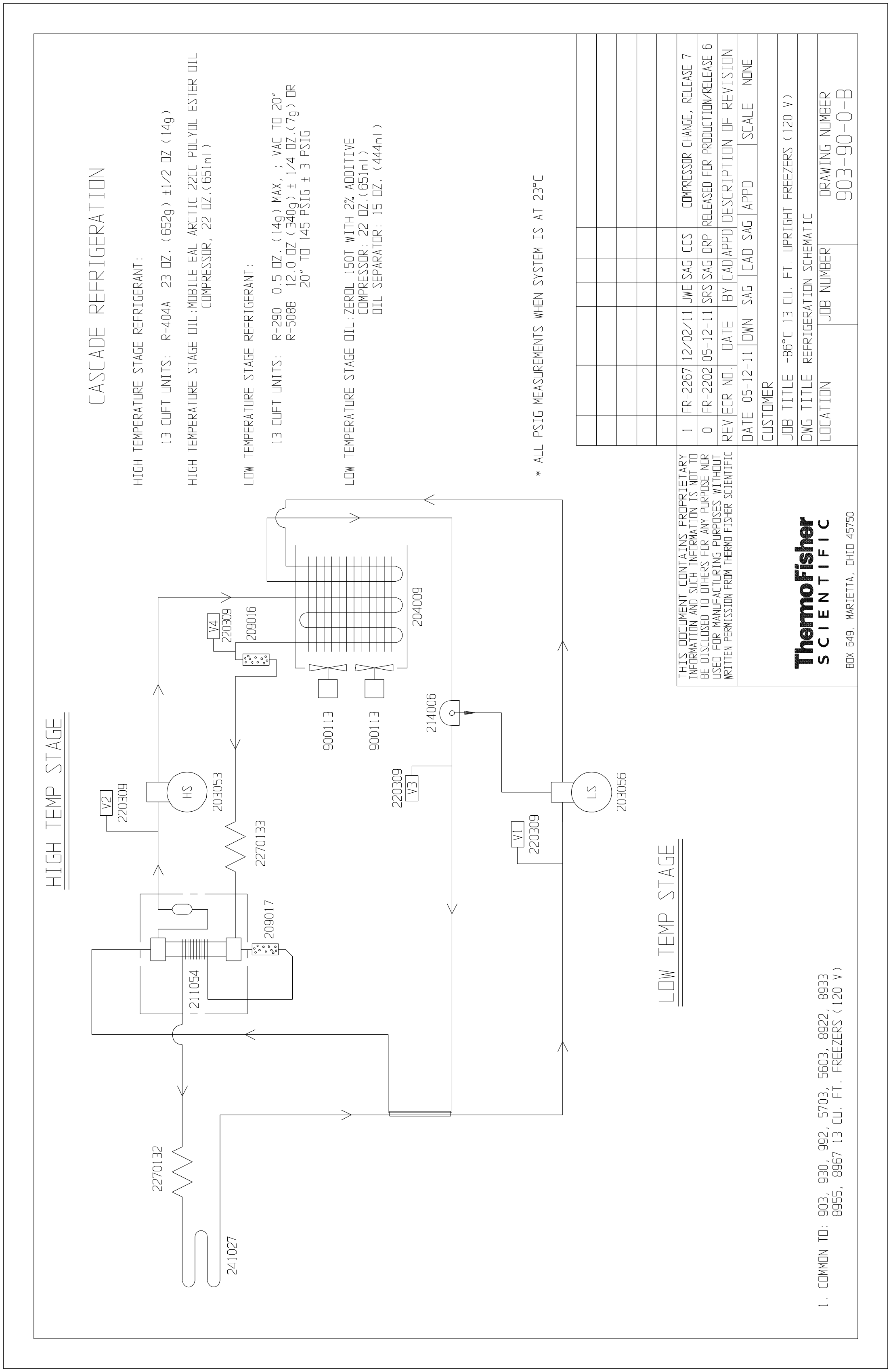
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

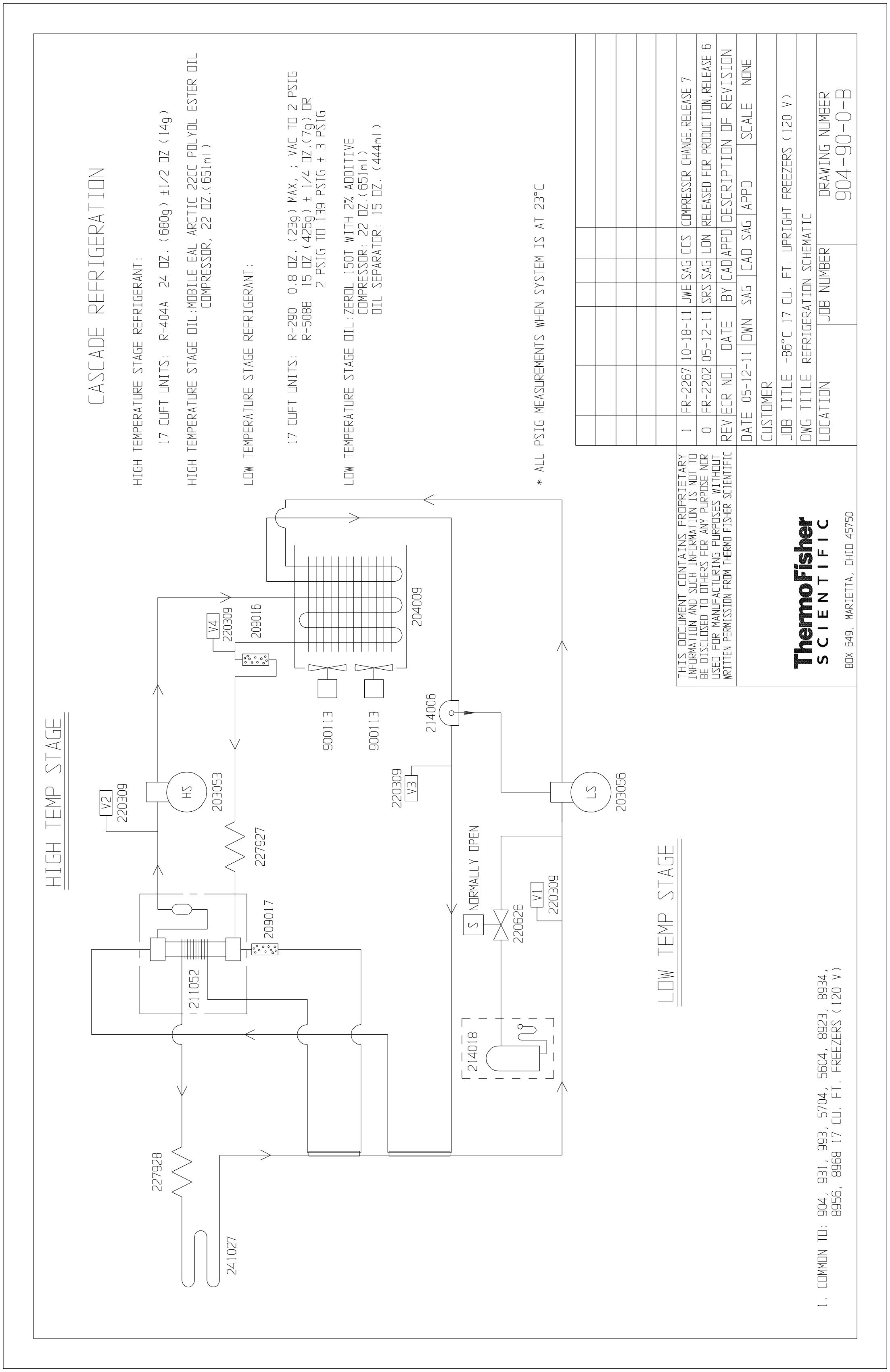
1. COMMON TO: 902, 909, 933, 943, 947, 968, 986, 991, 996, 5702, 5602, 8920, 8921, 8931, 8932, 8953, 8954, 8965, 8966 13 CU. FT. FREEZERS (230 V)

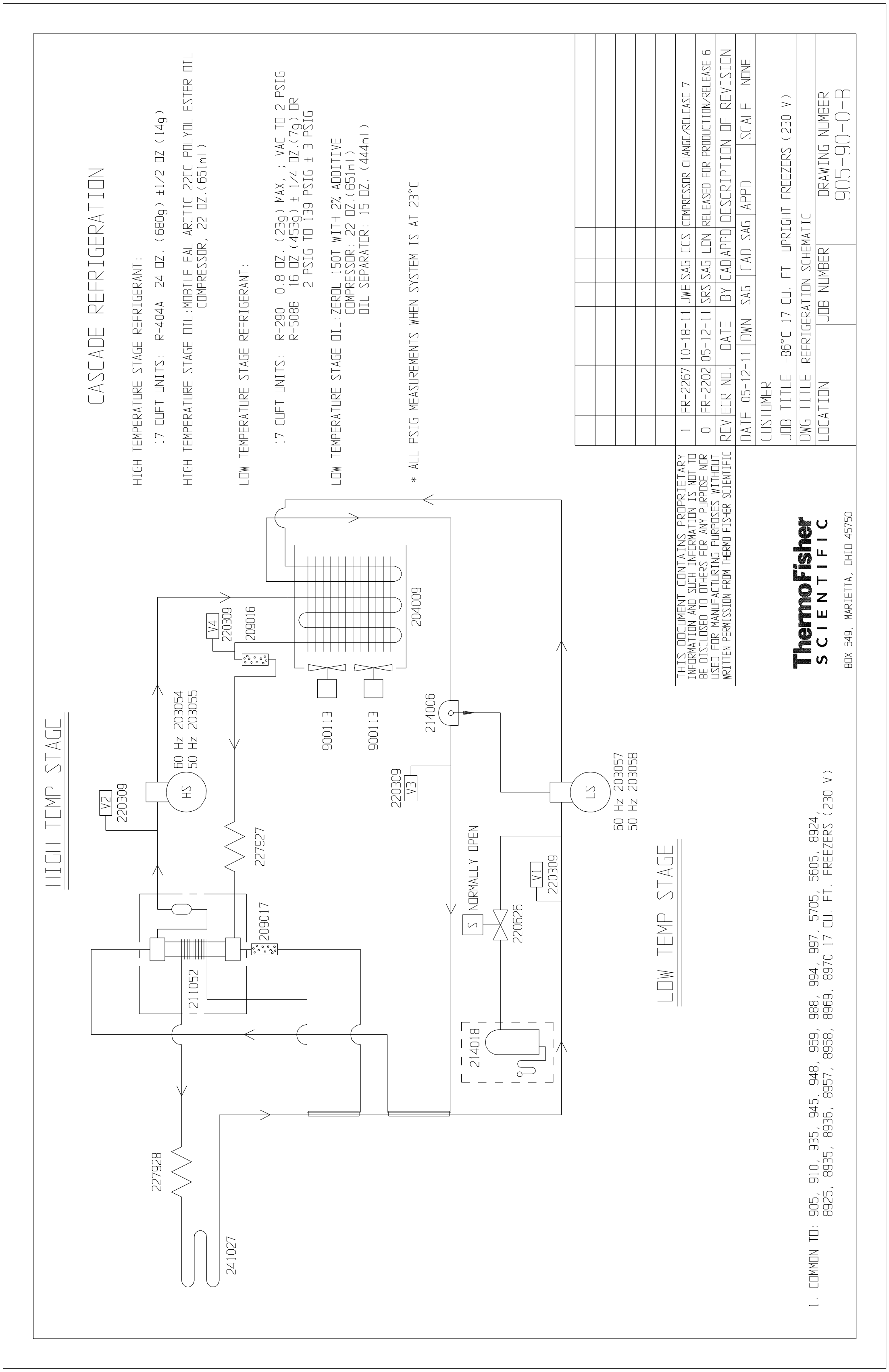
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

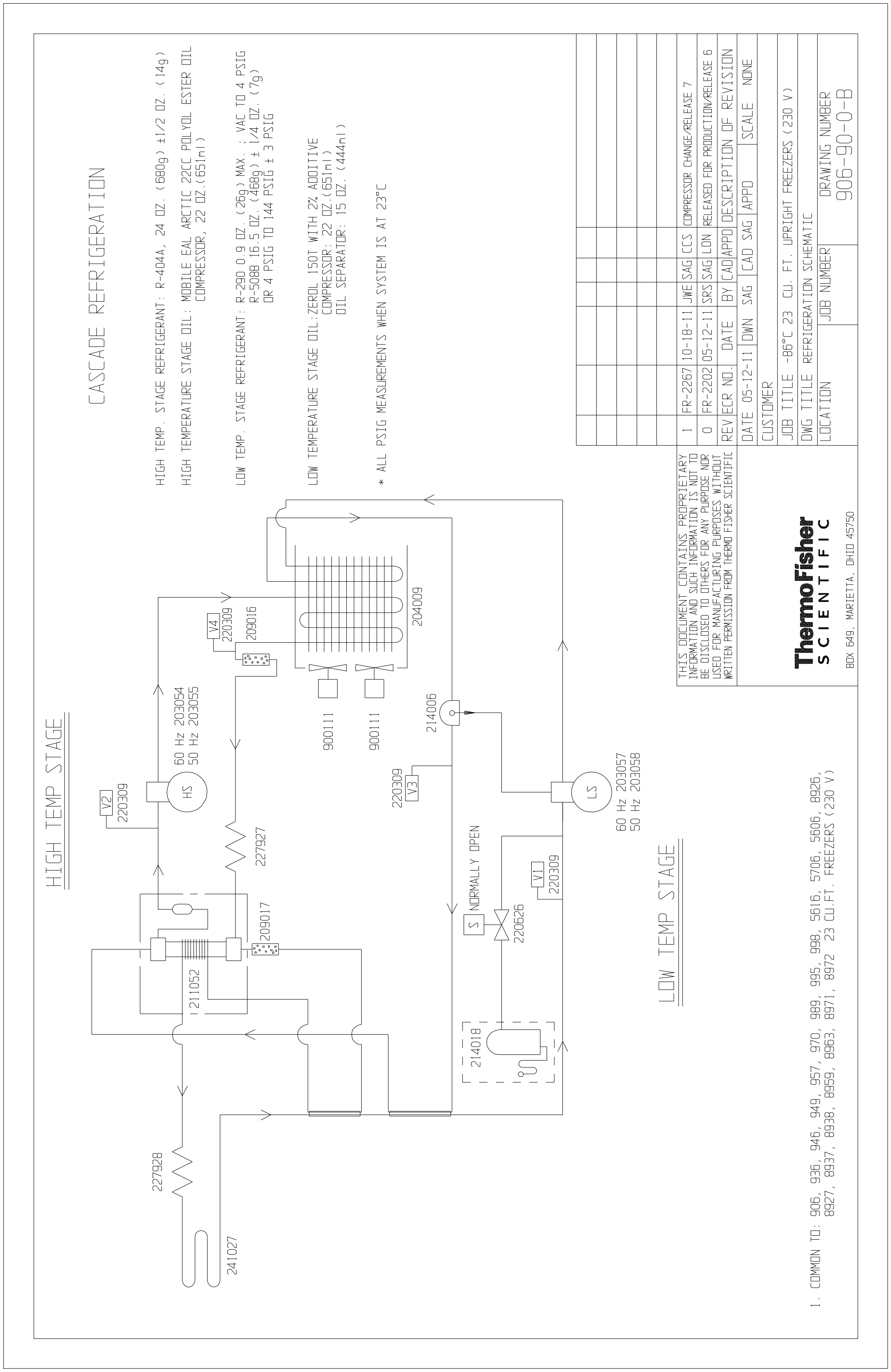
REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
1	FR-2267	12/02/11	JWE	SAG	CCS	COMPRESSOR CHANGE, RELEASE 7
0	FR-2202	05/12/11	SRS	SAG	DRP	RELEASED FOR PRODUCTION/RELEASE 6

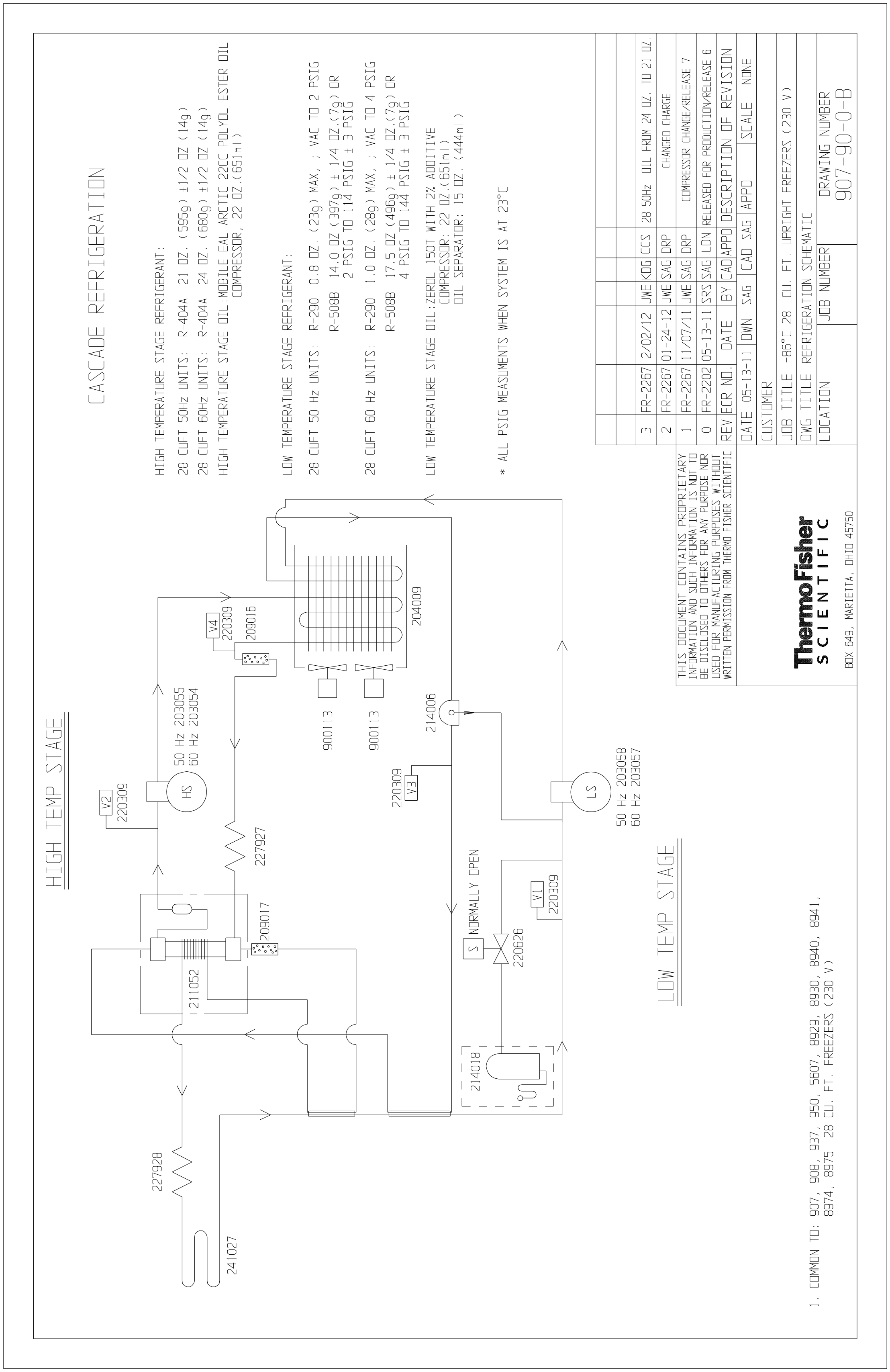
DATE 05-12-11 | DWN SAG | CAD SAG | APPD | SCALE NONE
CUSTOMER
JOB TITLE -86°C 13 CU. FT. UPRIGHT FREEZERS (230 V)
DWG TITLE REFRIGERATION SCHEMATIC
LOCATION | JOB NUMBER | DRAWING NUMBER 902-90-0-B

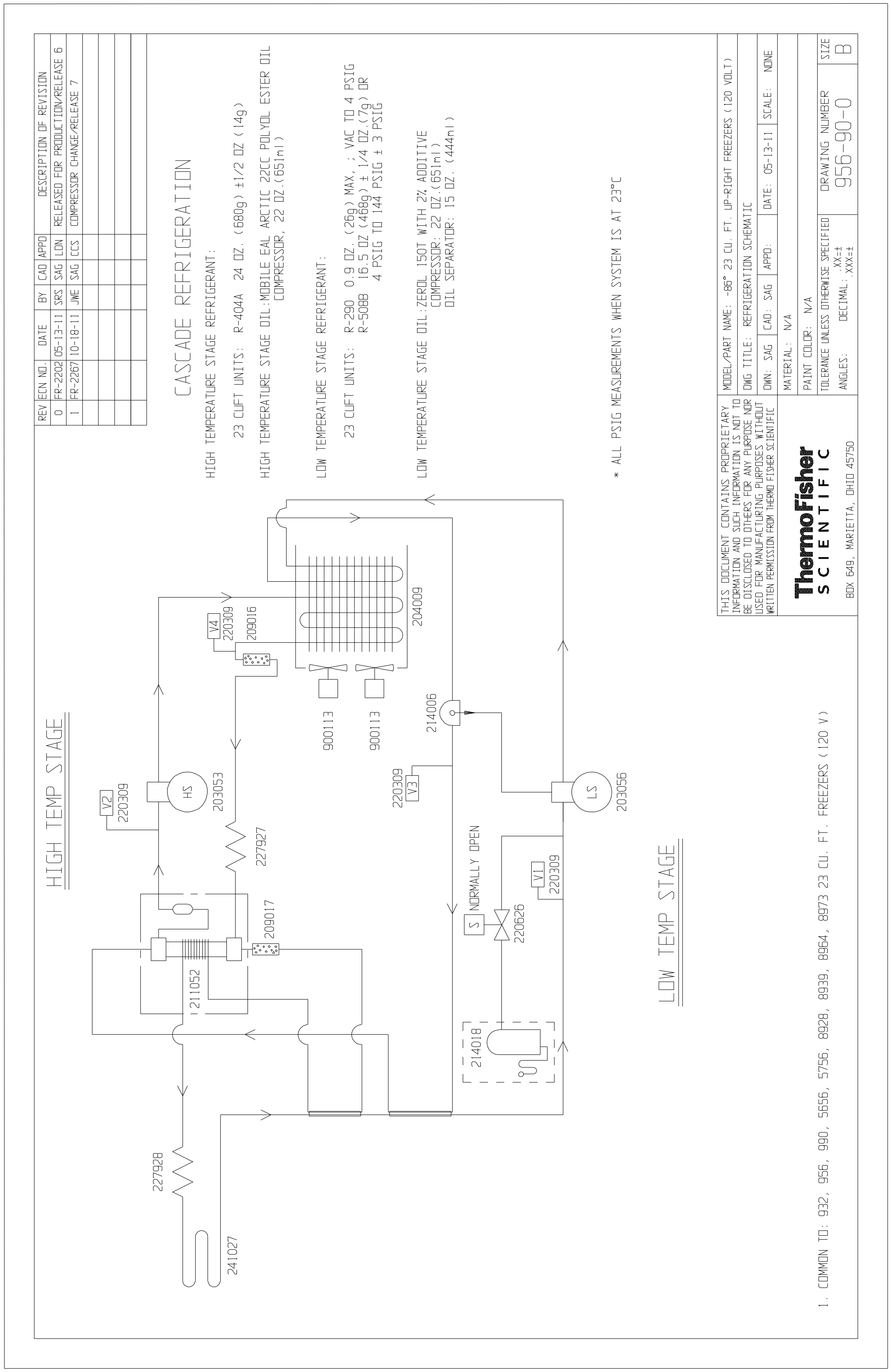

CASCADE REFRIGERATION
HIGH TEMPERATURE STAGE REFRIGERANT:
13 CUFT UNITS: R-404A 23 OZ. (652g) ±1/2 OZ (14g)
HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ.(651ml)
LOW TEMPERATURE STAGE REFRIGERANT:
13 CUFT UNITS: R-290 0.5 OZ. (14g) MAX, ; VAC TO 20"
R-508B 12.0 OZ (340g) ± 1/4 OZ.(7g) OR
20" TO 145 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C
HIGH TEMP STAGE
LOW TEMP STAGE
V4 220309
209016
204009
900113
900113
214006
V2 220309
HS
203053
2270133
220309 V3
V1 220309
LS
203056
209017
211054
2270132
241027
1. COMMON TO: 903, 930, 992, 5703, 5603, 8922, 8933
8955, 8967 13 CU. FT. FREEZERS (120 V)
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Thermo Fisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750
1 FR-2267 12/02/11 JWE SAG CCS COMPRESSOR CHANGE, RELEASE 7
0 FR-2202 05-12-11 SRS SAG DRP RELEASED FOR PRODUCTION/RELEASE 6
REV ECR NO. DATE BY CAD APPD DESCRIPTION OF REVISION
DATE 05-12-11 DWN SAG CAD SAG APPD SCALE NONE
CUSTOMER
JOB TITLE -86°C 13 CU. FT. UPRIGHT FREEZERS (120 V)
DWG TITLE REFRIGERATION SCHEMATIC
LOCATION JOB NUMBER DRAWING NUMBER
903-90-0-B

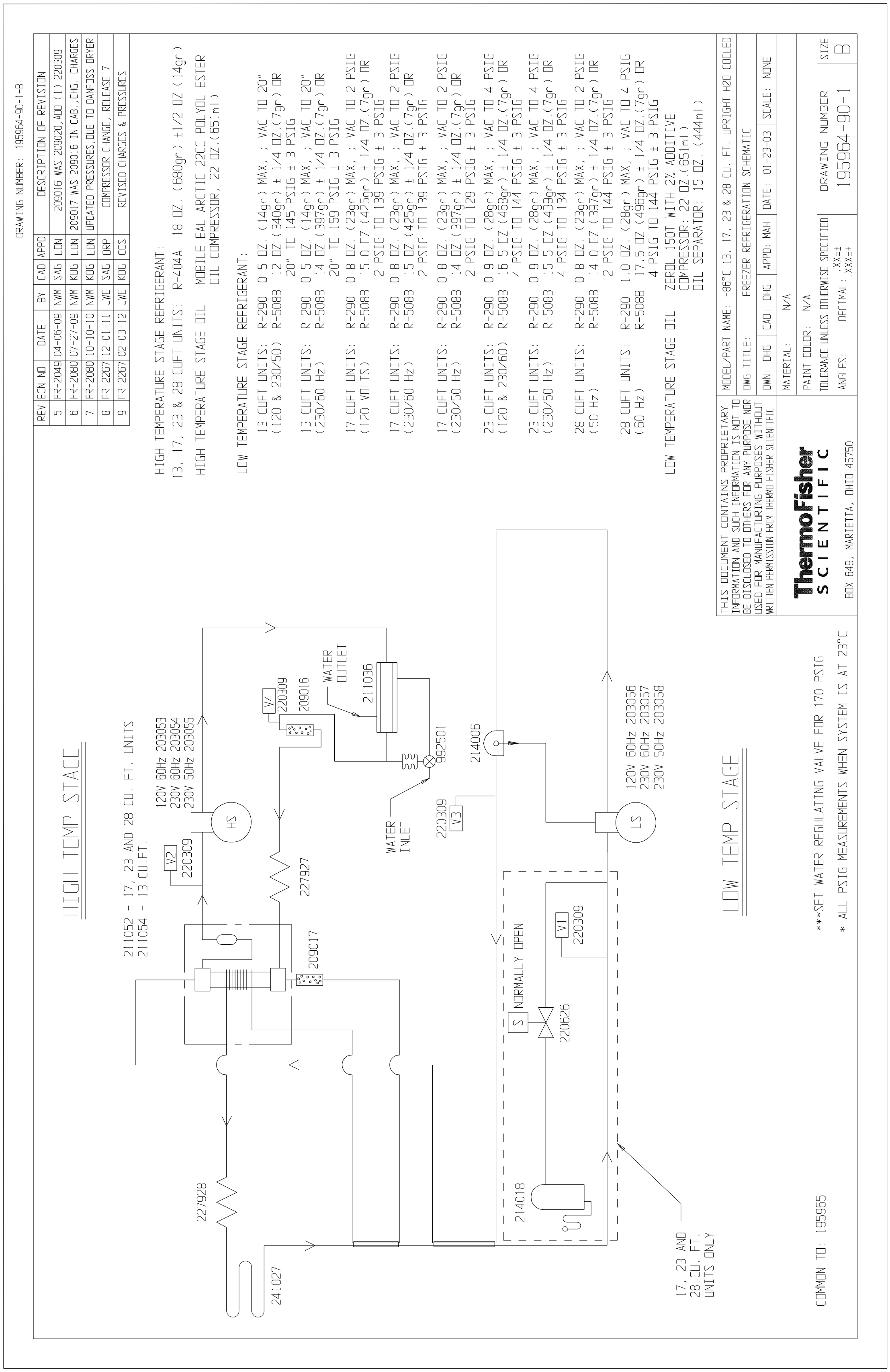

HIGH TEMP STAGE
LOW TEMP STAGE
227928
241027
211052
209017
V2
220309
HS
203053
227927
V4
220309
209016
900113
900113
204009
220309
V3
214006
214018
S
NORMALLY OPEN
220626
V1
220309
LS
203056
CASCADE REFRIGERATION
HIGH TEMPERATURE STAGE REFRIGERANT:
17 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)
HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ.(651ml)
LOW TEMPERATURE STAGE REFRIGERANT:
17 CUFT UNITS: R-290 0.8 OZ. (23g) MAX, ; VAC TO 2 PSIG
R-508B 15 OZ (425g) ± 1/4 OZ.(7g) OR
2 PSIG TO 139 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C
1. COMMON TO: 904, 931, 993, 5704, 5604, 8923, 8934,
8956, 8968 17 CU. FT. FREEZERS (120 V)
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BOX 649, MARIETTA, OHIO 45750
1 FR-2267 10-18-11 JWE SAG CCS COMPRESSOR CHANGE,RELEASE 7
0 FR-2202 05-12-11 SRS SAG LON RELEASED FOR PRODUCTION,RELEASE 6
REV ECR NO. DATE BY CAD APPD DESCRIPTION OF REVISION
DATE 05-12-11 DWN SAG CAD SAG APPD SCALE NONE
CUSTOMER
JOB TITLE -86°C 17 CU. FT. UPRIGHT FREEZERS (120 V)
DWG TITLE REFRIGERATION SCHEMATIC
LOCATION JOB NUMBER DRAWING NUMBER
904-90-0-B

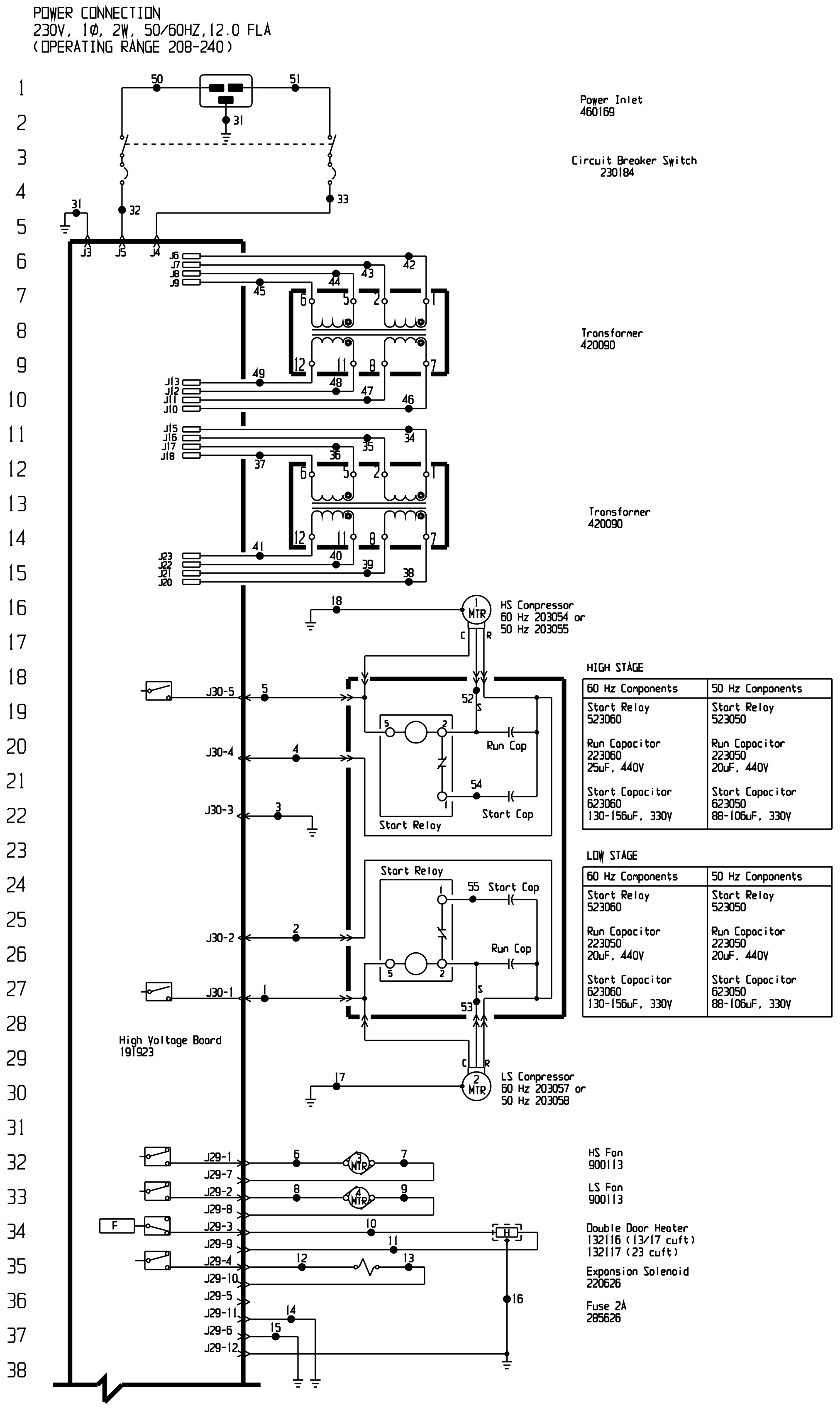

CASCADE REFRIGERATION
HIGH TEMPERATURE STAGE REFRIGERANT:
17 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)
HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ. (651ml)
LOW TEMPERATURE STAGE REFRIGERANT:
17 CUFT UNITS: R-290 0.8 OZ. (23g) MAX., ; VAC TO 2 PSIG
R-508B 16 OZ (453g) ± 1/4 OZ. (7g) OR
2 PSIG TO 139 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ. (651ml)
OIL SEPARATOR: 15 OZ. (444ml)
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C
HIGH TEMP STAGE
LOW TEMP STAGE
V2 220309
HS
60 Hz 203054
50 Hz 203055
V4 220309
209016
204009
900113
900113
214006
220309 V3
LS
60 Hz 203057
50 Hz 203058
227927
209017
211052
S NORMALLY OPEN
220626
V1 220309
214018
227928
241027
1. COMMON TO: 905, 910, 935, 945, 948, 969, 988, 994, 997, 5705, 5605, 8924,
8925, 8935, 8936, 8957, 8958, 8969, 8970 17 CU. FT. FREEZERS (230 V)
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ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750
1 FR-2267 10-18-11 JWE SAG CCS COMPRESSOR CHANGE/RELEASE 7
0 FR-2202 05-12-11 SRS SAG LON RELEASED FOR PRODUCTION/RELEASE 6
REV ECR NO. DATE BY CAD APPD DESCRIPTION OF REVISION
DATE 05-12-11 DWN SAG CAD SAG APPD SCALE NONE
CUSTOMER
JOB TITLE -86°C 17 CU. FT. UPRIGHT FREEZERS (230 V)
DWG TITLE REFRIGERATION SCHEMATIC
LOCATION JOB NUMBER DRAWING NUMBER 905-90-0-B


CASCADE REFRIGERATION
HIGH TEMP. STAGE REFRIGERANT: R-404A, 24 OZ. (680g) ±1/2 OZ. (14g)
HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ.(651ml)
LOW TEMP. STAGE REFRIGERANT: R-290 0.9 OZ. (26g) MAX. ; VAC TO 4 PSIG
R-508B 16.5 OZ. (468g) ± 1/4 OZ. (7g)
OR 4 PSIG TO 144 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C
HIGH TEMP STAGE
LOW TEMP STAGE
V2 220309
HS
60 Hz 203054
50 Hz 203055
V4 220309
209016
204009
90011
90011
214006
227927
209017
211052
241027
227928
220309 V3
LS
60 Hz 203057
50 Hz 203058
NORMALLY OPEN
S
220626
V1 220309
214018
1. COMMON TO: 906, 936, 946, 949, 957, 970, 989, 995, 998, 5616, 5706, 5606, 8926,
8927, 8937, 8938, 8959, 8963, 8971, 8972 23 CU.FT. FREEZERS (230 V)
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT WRITTEN PERMISSION FROM THERMO FISHER SCIENTIFIC
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750
1 FR-2267 10-18-11 JWE SAG CCS COMPRESSOR CHANGE/RELEASE 7
0 FR-2202 05-12-11 SRS SAG LDN RELEASED FOR PRODUCTION/RELEASE 6
REV ECR NO. DATE BY CAD APPD DESCRIPTION OF REVISION
DATE 05-12-11 DWN SAG CAD SAG APPD SCALE NONE
CUSTOMER
JOB TITLE -86°C 23 CU. FT. UPRIGHT FREEZERS (230 V)
DWG TITLE REFRIGERATION SCHEMATIC
LOCATION JOB NUMBER DRAWING NUMBER
906-90-0-B


HIGH TEMP STAGE
CASCADE REFRIGERATION
V2
220309
227928
HS
50 Hz 203055
60 Hz 203054
211052
241027
V4
220309
209017
227927
209016
900113
900113
220309
V3
204009
214006
214018
S
NORMALLY OPEN
220626
V1
220309
LS
50 Hz 203058
60 Hz 203057
LOW TEMP STAGE
HIGH TEMPERATURE STAGE REFRIGERANT:
28 CUFT 50Hz UNITS: R-404A 21 OZ. (595g) ±1/2 OZ (14g)
28 CUFT 60Hz UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)
HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ.(651ml)
LOW TEMPERATURE STAGE REFRIGERANT:
28 CUFT 50 Hz UNITS: R-290 0.8 OZ. (23g) MAX, ; VAC TO 2 PSIG
R-508B 14.0 OZ (397g) ± 1/4 OZ.(7g) OR
2 PSIG TO 114 PSIG ± 3 PSIG
28 CUFT 60 Hz UNITS: R-290 1.0 OZ. (28g) MAX, ; VAC TO 4 PSIG
R-508B 17.5 OZ (496g) ± 1/4 OZ.(7g) OR
4 PSIG TO 144 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)
* ALL PSIG MEASUMENTS WHEN SYSTEM IS AT 23°C
3 FR-2267 2/02/12 JWE KDG CCS 28 50Hz OIL FROM 24 OZ. TO 21 OZ.
2 FR-2267 01-24-12 JWE SAG DRP CHANGED CHARGE
1 FR-2267 11/07/11 JWE SAG DRP COMPRESSOR CHANGE/RELEASE 7
0 FR-2202 05-13-11 SRS SAG LON RELEASED FOR PRODUCTION/RELEASE 6
REV ECR NO. DATE BY CAD APPD DESCRIPTION OF REVISION
DATE 05-13-11 DWN SAG CAD SAG APPD SCALE NONE
CUSTOMER
JOB TITLE -86°C 28 CU. FT. UPRIGHT FREEZERS (230 V)
DWG TITLE REFRIGERATION SCHEMATIC
LOCATION JOB NUMBER DRAWING NUMBER
907-90-0-B
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT WRITTEN PERMISSION FROM THERMO FISHER SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750
1. COMMON TO: 907, 908, 937, 950, 5607, 8929, 8930, 8940, 8941,
8974, 8975 28 CU. FT. FREEZERS (230 V)


HIGH TEMP STAGE
LOW TEMP STAGE
227928
241027
211052
209017
227927
V2
220309
HS
203053
V4
220309
209016
900113
900113
204009
V3
220309
214006
214018
S NORMALLY OPEN
220626
V1
220309
LS
203056
REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION
0 | FR-2202 | 05-13-11 | SRS | SAG | LDN | RELEASED FOR PRODUCTION/RELEASE 6
1 | FR-2267 | 10-18-11 | JWE | SAG | CCS | COMPRESSOR CHANGE/RELEASE 7
CASCADE REFRIGERATION
HIGH TEMPERATURE STAGE REFRIGERANT:
23 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)
HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL COMPRESSOR, 22 OZ.(651ml)
LOW TEMPERATURE STAGE REFRIGERANT:
23 CUFT UNITS: R-290 0.9 OZ. (26g) MAX, ; VAC TO 4 PSIG
R-508B 16.5 OZ (468g) ± 1/4 OZ.(7g) OR 4 PSIG TO 144 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C
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ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750
MODEL/PART NAME: -86° 23 CU. FT. UP-RIGHT FREEZERS (120 VOLT)
DWG TITLE: REFRIGERATION SCHEMATIC
DWN: SAG | CAD: SAG | APPD: | DATE: 05-13-11 | SCALE: NONE
MATERIAL: N/A
PAINT COLOR: N/A
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER
956-90-0
SIZE
B
1. COMMON TO: 932, 956, 990, 5656, 5756, 8928, 8939, 8964, 8973 23 CU. FT. FREEZERS (120 V)


DRAWING NUMBER: 195964-90-1-B
REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION
5 | FR-2049 | 04-06-09 | NWM | SAG | LDN | 209016 WAS 209020, ADD (1) 220309
6 | FR-2080 | 07-27-09 | NWM | KDG | LDN | 209017 WAS 209016 IN CAB., CHG. CHARGES
7 | FR-2080 | 10-10-10 | NWM | KDG | LDN | UPDATED PRESSURES, DUE TO DANFOSS DRYER
8 | FR-2267 | 12-01-11 | JWE | SAG | DRP | COMPRESSOR CHANGE, RELEASE 7
9 | FR-2267 | 02-03-12 | JWE | KDG | CCS | REVISED CHARGES & PRESSURES
HIGH TEMP STAGE
211052 - 17, 23 AND 28 CU. FT. UNITS
211054 - 13 CU.FT.
V2
220309
120V 60Hz 203053
230V 60Hz 203054
230V 50Hz 203055
HS
227928
241027
209017
227927
V4
220309
209016
WATER
OUTLET
211036
WATER
INLET
220309
V3
992501
214006
214018
S
NORMALLY OPEN
220626
V1
220309
LS
120V 60Hz 203056
230V 60Hz 203057
230V 50Hz 203058
17, 23 AND
28 CU. FT.
UNITS ONLY
LOW TEMP STAGE
COMMON TO: 195965
***SET WATER REGULATING VALVE FOR 170 PSIG
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C
HIGH TEMPERATURE STAGE REFRIGERANT:
13, 17, 23 & 28 CUFT UNITS: R-404A 18 OZ. (680gr) ±1/2 OZ (14gr)
HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER
OIL COMPRESSOR, 22 OZ.(651ml)
LOW TEMPERATURE STAGE REFRIGERANT:
13 CUFT UNITS: (120 & 230/50) R-290 0.5 OZ. (14gr) MAX, ; VAC TO 20"
R-508B 12 OZ (340gr) ± 1/4 OZ.(7gr) OR
20" TO 145 PSIG ± 3 PSIG
13 CUFT UNITS: (230/60 Hz) R-290 0.5 OZ. (14gr) MAX, ; VAC TO 20"
R-508B 14 OZ (397gr) ± 1/4 OZ.(7gr) OR
20" TO 159 PSIG ± 3 PSIG
17 CUFT UNITS: (120 VOLTS) R-290 0.8 OZ. (23gr) MAX, ; VAC TO 2 PSIG
R-508B 15.0 OZ (425gr) ± 1/4 OZ.(7gr) OR
2 PSIG TO 139 PSIG ± 3 PSIG
17 CUFT UNITS: (230/60 Hz) R-290 0.8 OZ. (23gr) MAX, ; VAC TO 2 PSIG
R-508B 15 OZ (425gr) ± 1/4 OZ.(7gr) OR
2 PSIG TO 139 PSIG ± 3 PSIG
17 CUFT UNITS: (230/50 Hz) R-290 0.8 OZ. (23gr) MAX, ; VAC TO 2 PSIG
R-508B 14 OZ (397gr) ± 1/4 OZ.(7gr) OR
2 PSIG TO 129 PSIG ± 3 PSIG
23 CUFT UNITS: (120 & 230/60) R-290 0.9 OZ. (28gr) MAX, ; VAC TO 4 PSIG
R-508B 16.5 OZ (468gr) ± 1/4 OZ.(7gr) OR
4 PSIG TO 144 PSIG ± 3 PSIG
23 CUFT UNITS: (230/50 Hz) R-290 0.9 OZ. (28gr) MAX, ; VAC TO 4 PSIG
R-508B 15.5 OZ (439gr) ± 1/4 OZ.(7gr) OR
4 PSIG TO 134 PSIG ± 3 PSIG
28 CUFT UNITS: (50 Hz) R-290 0.8 OZ. (23gr) MAX, ; VAC TO 2 PSIG
R-508B 14.0 OZ (397gr) ± 1/4 OZ.(7gr) OR
2 PSIG TO 144 PSIG ± 3 PSIG
28 CUFT UNITS: (60 Hz) R-290 1.0 OZ. (28gr) MAX, ; VAC TO 4 PSIG
R-508B 17.5 OZ (496gr) ± 1/4 OZ.(7gr) OR
4 PSIG TO 144 PSIG ± 3 PSIG
LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)
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ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750
MODEL/PART NAME: -86°C 13, 17, 23 & 28 CU. FT. UPRIGHT H2O COOLED
DWG TITLE: FREEZER REFRIGERATION SCHEMATIC
DWN: DHG | CAD: DHG | APPD: MAH | DATE: 01-23-03 | SCALE: NONE
MATERIAL: N/A
PAINT COLOR: N/A
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 195964-90-1
SIZE B



HIGH STAGE

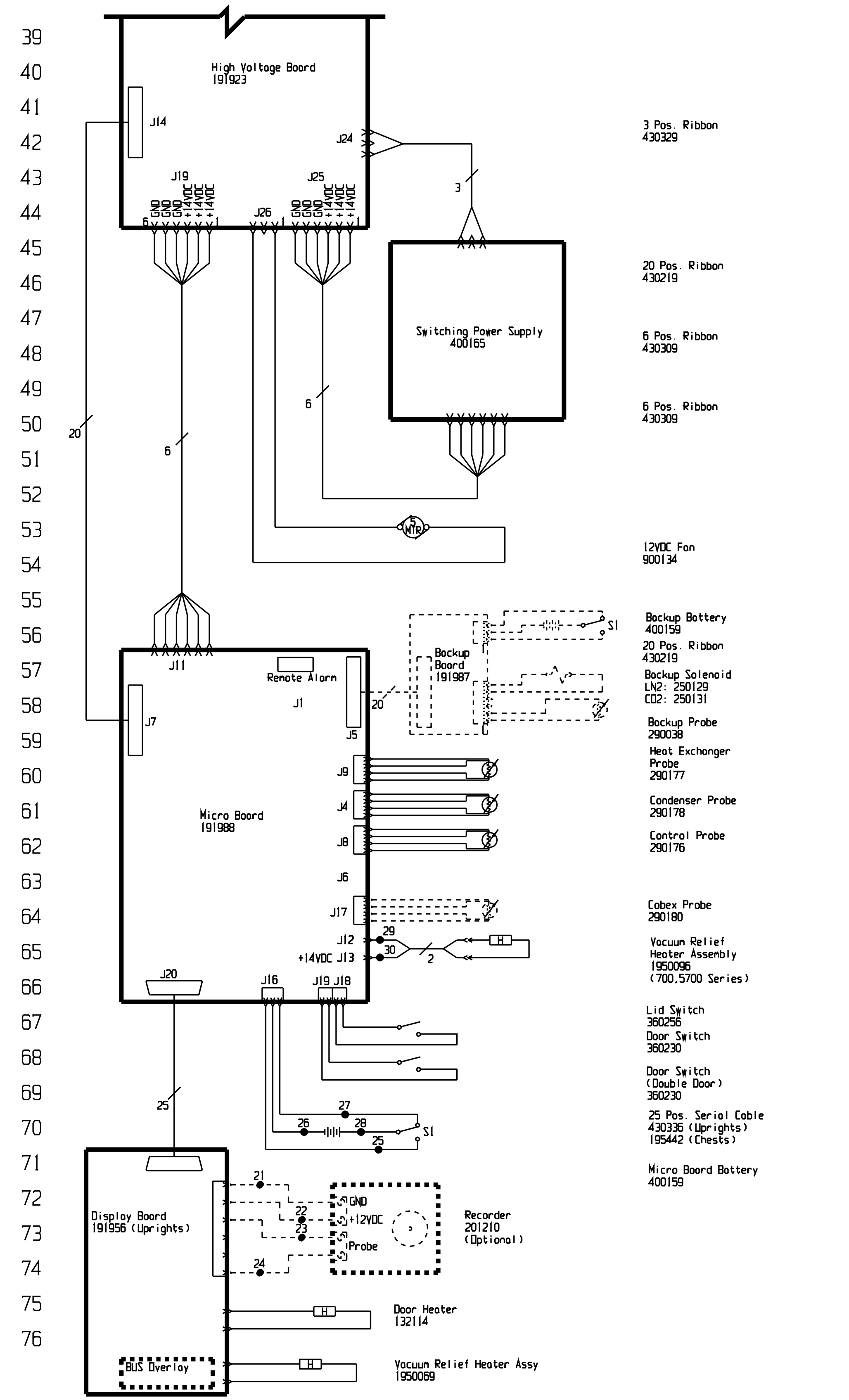
60 Hz Components	50 Hz Components
Start Relay 523060	Start Relay 523050
Run Capacitor 223060 25uF, 440V	Run Capacitor 223050 20uF, 440V
Start Capacitor 623060 130-156uF, 330V	Start Capacitor 623050 88-106uF, 330V

LOW STAGE

60 Hz Components	50 Hz Components
Start Relay 523060	Start Relay 523050
Run Capacitor 223050 20uF, 440V	Run Capacitor 223050 20uF, 440V
Start Capacitor 623060 130-156uF, 330V	Start Capacitor 623050 88-106uF, 330V

Electrical Schematic
Model:
230V ULT Upright
-86C Freezer

902-70-2-D Rev. 3
Page 1 of 3



Electrical Schematic
Model:
230V ULT Upright
-86C Freezer

902-70-2-D Rev. 3
Page 2 of 3

WIRE #	COLOR	GAUGE	WIRE #	COLOR	GAUGE
1	BLK	14	29	BLK	22
2	RED	14	30	RED	22
3	GRN/YEL	14	31	GRN/YEL	14
4	RED	14	32	BLK	14
5	BLK	14	33	BLU	14
6	BLK	18	34	BLK	14
7	BLK	18	35	BLU	14
8	BLK	18	36	BLK	14
9	BLK	18	37	BLU	14
10	BLK	18	38	BLK	14
11	BLK	18	39	BLU	14
12	BLK	18	40	BLK	14
13	BLK	18	41	BLU	14
14	GRN/YEL	18	42	BLK	14
15	GRN/YEL	18	43	BLU	14
16	GRN/YEL	18	44	BLK	14
17	GRN/YEL	14	45	BLU	14
18	GRN/YEL	14	46	BLK	14
19	-	-	47	BLU	14
20	-	-	48	BLK	14
21	BLK	18	49	BLU	14
22	RED	18	50	BLK	14
23	BLK	18	51	BLU	14
24	RED	18	52	YEL/WHT	14
25	WHT	18	53	YEL	14
26	BLK	18	54	BLU/WHT	14
27	BLK	18	55	BLU	14
28	RED	18			

UPRIGHT MODELS:
13 CU.FT. - 8920, 8921, 8931, 8932, 8953, 8954, 902, 909, 933, 943, 947, 968, 986, 991, 996, 5702
17 CU.FT. - 8924, 8925, 8935, 8936, 8957, 8958, 905, 910, 935, 945, 948, 969, 988, 994, 997, 5705
23 CU.FT. - 8926, 8927, 8937, 8938, 8959, 8963, 906, 936, 946, 949, 957, 970, 989, 995, 998, 5706
28 CU.FT. - 8929, 8930, 8940, 8941, 907, 908, 937, 950

REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Not Connected
PIN# 2	Not Connected
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common.
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

SW3 SETTINGS

	1	2	3	4	5	6	7	8
ON		☐	☐			☐		
OFF	☐			☐	☐		☐	☐

1. Schematic represents single & double door upright models and chest models. All heaters are for uprights only. Expansion solenoid on 17, 23 & 28 cuft uprights only.
2. Door switches shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and acessories shown in dashed lines.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	FR-2361	05-08-12	MAM	KDG	CCS	CHG. LOW STAGE RUN CAP. 25uF TO 20uF
2	FR-2267	10/20/11	JWE	SAG	DRP	COMPRESSOR CHANGE / RELEASE 7
1	FR-2202	05/02/11	SRS	SAG	LDN	LIBERTY CAP / RELEASE 6
0	N/A	10-10-10	HCE	KDG	LDN	RELEASED FOR PRODUCTION / RELEASE 5

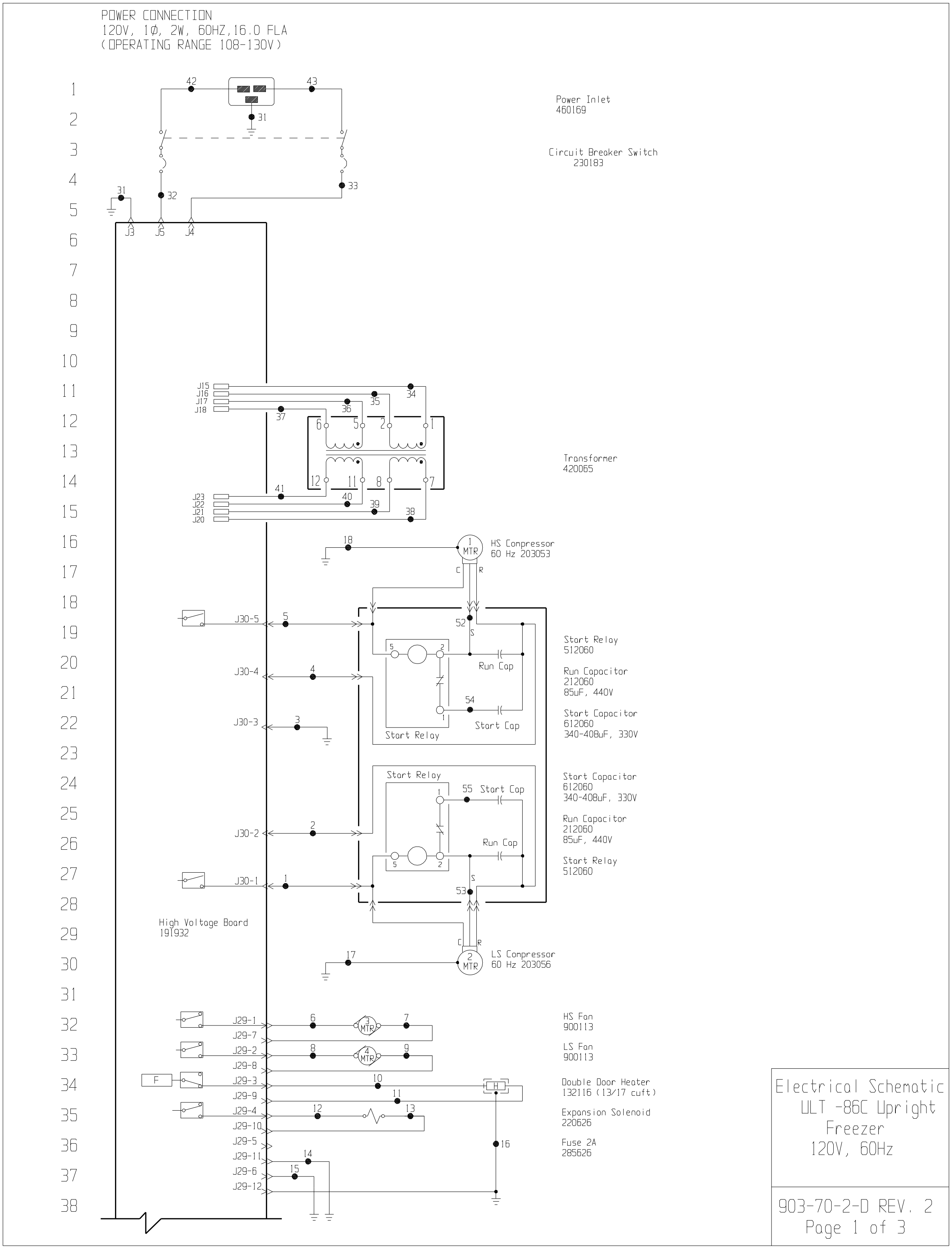
ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

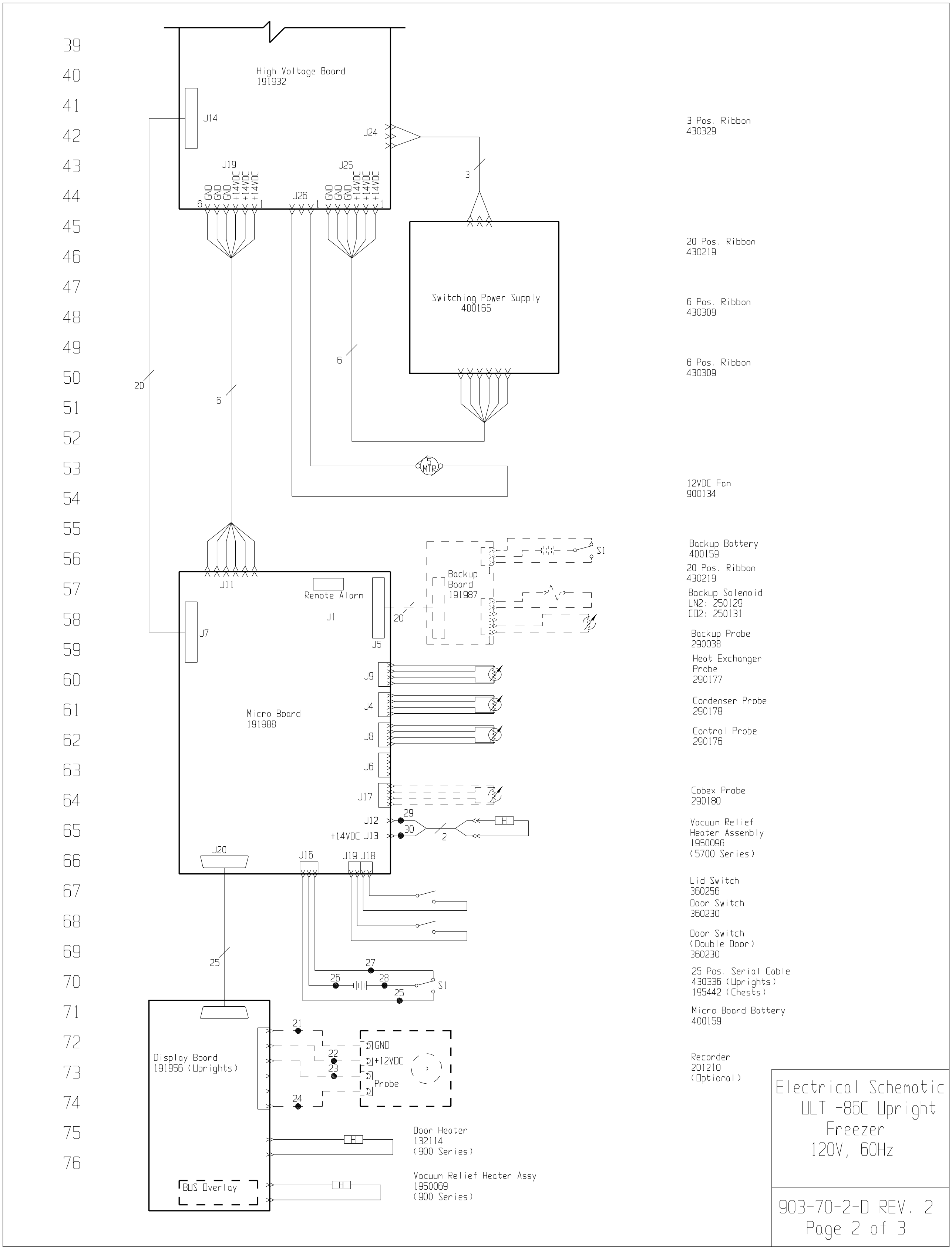
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME: LOW-END, ULT -86C UPRIGHT FREEZERS, 230V, 50 & 60 Hz
DWG TITLE: UNIT SCHEMATIC
DWN: HCE | CAD: KDG | APPD: LDN | DATE: 10-10-10 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 902-70-2
SIZE D

Electrical Schematic
Model:
230V ULT Upright
-86C Freezer

902-70-2-D Rev. 3
Page 3 of 3


POWER CONNECTION
120V, 1Ø, 2W, 60HZ,16.0 FLA
(OPERATING RANGE 108-130V)
Power Inlet
460169
Circuit Breaker Switch
230183
Transformer
420065
HS Compressor
60 Hz 203053
Start Relay
512060
Run Capacitor
212060
85uF, 440V
Start Capacitor
612060
340-408uF, 330V
Start Capacitor
612060
340-408uF, 330V
Run Capacitor
212060
85uF, 440V
Start Relay
512060
Run Cap
Start Cap
Start Relay
High Voltage Board
191932
LS Compressor
60 Hz 203056
HS Fan
900113
LS Fan
900113
Double Door Heater
132116 (13/17 cuft)
Expansion Solenoid
220626
Fuse 2A
285626
Electrical Schematic
ULT -86C Upright
Freezer
120V, 60Hz
903-70-2-D REV. 2
Page 1 of 3


High Voltage Board
191932
J14
J24
J19
J25
J26
GND GND GND +14VDC +14VDC +14VDC
GND GND GND +14VDC +14VDC +14VDC
3 Pos. Ribbon
430329
Switching Power Supply
400165
20 Pos. Ribbon
430219
6 Pos. Ribbon
430309
6 Pos. Ribbon
430309
12VDC Fan
900134
Backup Battery
400159
20 Pos. Ribbon
430219
Backup
Board
191987
Backup Solenoid
LN2: 250129
CO2: 250131
Backup Probe
290038
Remote Alarm
J11
J1
J7
J5
Heat Exchanger
Probe
290177
Micro Board
191988
J9
J4
J8
J6
J17
Condenser Probe
290178
Control Probe
290176
Cobex Probe
290180
J12
+14VDC J13
Vacuum Relief
Heater Assembly
1950096
(5700 Series)
J20
J16
J19 J18
Lid Switch
360256
Door Switch
360230
Door Switch
(Double Door)
360230
25 Pos. Serial Cable
430336 (Uprights)
195442 (Chests)
Micro Board Battery
400159
Display Board
191956 (Uprights)
GND
+12VDC
Probe
Recorder
201210
(Optional)
Door Heater
132114
(900 Series)
BUS Overlay
Vacuum Relief Heater Assy
1950069
(900 Series)
Electrical Schematic
ULT -86C Upright
Freezer
120V, 60Hz
903-70-2-D REV. 2
Page 2 of 3

WIRE #	COLOR	GAUGE	WIRE #	COLOR	GAUGE
1	BLK	14	29	BLK	22
2	RED	14	30	RED	22
3	GRN/YEL	14	31	GRN/YEL	14
4	RED	14	32	BLK	14
5	BLK	14	33	BLU	14
6	BLK	18	34	BLK	14
7	BLK	18	35	BLU	14
8	BLK	18	36	BLK	14
9	BLK	18	37	BLU	14
10	BLK	18	38	BLK	14
11	BLK	18	39	BLU	14
12	BLK	18	40	BLK	14
13	BLK	18	41	BLU	14
14	GRN/YEL	18	42	BLK	14
15	GRN/YEL	18	43	BLU	14
16	GRN/YEL	18	44	-	-
17	GRN/YEL	14	45	-	-
18	GRN/YEL	14	46	-	-
19	-	-	47	-	-
20	-	-	48	-	-
21	BLK	18	49	-	-
22	RED	18	50	-	-
23	BLK	18	51	-	-
24	RED	18	52	YEL/WHT	14
25	WHT	18	53	YEL	14
26	BLK	18	54	BLU/WHT	14
27	BLK	18	55	BLU	14
28	RED	18			

UPRIGHT MODELS:
13 CU.FT. - 903, 930, 992, 5703, 8922, 8933, 8955
17 CU.FT. - 904, 931, 993, 5704, 8923, 8934, 8956
23 CU.FT. - 932, 956, 990, 5756, 8928, 8939, 8964

REMOTE CONTACTS/ANALOG OUTPUT
PIN# 1 Not Connected
PIN# 2 Not Connected
PIN# 3 Not Connected
PIN# 4 Not Connected
PIN# 5 Normally Closed
PIN# 6 Common.
PIN# 7 Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

SW3 SETTINGS

	1	2	3	4	5	6	7	8
ON		☐	☐			☐		
OFF	☐			☐	☐		☐	☐

1. Schematic represents single & double door upright models and chest models. All heaters are for uprights only. Expansion solenoid on 17 & 23 cuft uprights only.
2. Door switches shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and acessories shown in dashed lines.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
2	FR-2267	10/20/11	JWE	SAG	CCS	COMPRESSOR CHANGE / RELEASE 7
1	FR-2202	05/02/11	SRS	SAG	LDN	LIBERTY CAP / RELEASE 6
0	N/A	10-10-10	HCE	KDG	LDN	RELEASED FOR PRODUCTION / RELEASE 5

Electrical Schematic
ULT -86C Upright Freezer
120V, 60Hz

MODEL/PART NAME: LOW-END, ULT -86C UPRIGHT FREEZERS, 120V, 60Hz
DWG TITLE: UNIT SCHEMATIC
DWN: HCE | CAD: KDG | APPD: LDN | DATE: 10-10-10 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 903-70-2
SIZE D

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

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SCIENTIFIC
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903-70-2-D REV. 2
Page 3 of 3

THERMO FISHER SCIENTIFIC FREEZER WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period.

During the first two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. The ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

In addition to the standard warranty, the foamed-in-place cabinet design carries a unit production lifetime warranty (foamed-in-place cabinet, evaporator and foamed-in-place door; parts only). Please contact your sales representative or Thermo for additional information.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original two year warranty period. The Technical Services Department must give prior approval for the return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please call your Technical Services Department at 1-800-438-4851 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contact your local distributor for warranty information.

Rev. 0 6/11

ISO 9001 REGISTERED

THERMO FISHER SCIENTIFIC FREEZER INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period. Dealers who stock our equipment are allowed an additional four months for delivery and installation, providing the warranty card is completed and returned to the Technical Services Department.

During the first two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor excluded. The ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

In addition to the standard warranty, the foamed-in-place cabinet design carries a unit production lifetime warranty (foamed-in-place cabinet, evaporator and foamed-in-place door; parts only). Please contact your sales representative or Thermo for additional information.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original two year warranty period. The Technical Services Department must give prior approval for the return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please contact your local distributor or Thermo (1-800-438-4851 in USA and Canada, or 1-740-373-4763). We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contact your local distributor for warranty information.

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Appendix A Handling Liquid Nitrogen

Warning Contact of liquid nitrogen or cold gas with the skin or eyes may cause serious freezing (frostbite) injury. ▲

Handle liquid nitrogen carefully.

The extremely low temperature can freeze human flesh very rapidly. When spilled on a surface the liquid tends to cover it completely and intimately, cooling a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face.

Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen.

Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. Use tongs to withdraw objects immersed in the liquid, and handle the object carefully.

Wear protective clothing.

Protect your eyes with a face shield or safety goggles (safety glasses without side shields do not give adequate protection). Always wear gloves when handling anything that is, or may have been, in immediate contact with liquid nitrogen. Insulated gloves are recommended, but heavy leather gloves may also be used. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them. When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuffless if possible) should be worn outside the shoes.

Introduction

The safe handling and use of liquid nitrogen in cryogenic refrigerators and dewar flasks is largely a matter of knowing the potential hazards and using common-sense procedures based on that knowledge. There are two important properties of liquid nitrogen that present potential hazards:

1. It is extremely cold. At atmospheric pressure, liquid nitrogen boils at -320°F (-196°C).

2. Very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes 24.6 cu. ft. (700l) of gas.

The safety precautions in this booklet must be followed to avoid potential injury or damage which could result from these two characteristics. Do not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions. Keep this booklet handy for ready reference and review.

Note Because argon is an inert gas whose physical properties are very similar to those of nitrogen, the precautions and safe practices for the handling and use of liquid argon are the same as those for liquid nitrogen. ▲

Use only containers designed for low temperature liquids.

Cryogenic containers are specifically designed and made of materials that can withstand the rapid changes and extreme temperature differences encountered in working with liquid nitrogen. Even these special containers should be filled SLOWLY to minimize the internal stresses that occur when any material is cooled. Excessive internal stresses can damage the container.

Do not cover or plug the entrance opening of any liquid nitrogen refrigerator or dewar. Do not use any stopper or other device that would interfere with venting of gas.

These cryogenic liquid containers are generally designed to operate with little or no internal pressure. Inadequate venting can result in excessive gas pressure which could damage or burst the container. Use only the loose-fitting necktube core supplied or one of the approved accessories for closing the necktube. Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.

Use proper transfer equipment.

Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar or refrigerator. The top of the funnel should be partly covered to reduce splashing. Use only small, easily-handled dewars for pouring liquid. For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device. When liquid cylinders or other large storage containers are used for filling, follow the instructions supplied with those units and their accessories.

Do not overfill containers.

Filling above the bottom of the necktube (or specified maximum level) can result in overflow and spillage of liquid when the necktube core or cover is placed in the opening.

Never use hollow rods or tubes as dipsticks.

When a warm tube is inserted into liquid nitrogen, liquid will spout from the top of the tube due to gasification and rapid expansion of liquid inside the tube.

Warning Nitrogen Gas Can Cause Suffocation Without Warning! ▲

Store and use liquid nitrogen only in a well-ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because nitrogen gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible. ▲

Never dispose of liquid nitrogen in confined areas or places where others may enter.

Disposal of liquid nitrogen should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

Appendix B Handling Liquid CO_2

Warning High concentrations of CO_2 gas can cause asphyxiation! OSHA Standards specify that employee exposure to carbon dioxide in any eight-hour shift of a 40-hour work week shall not exceed the eight-hour time weighted average of 5000 PPM (0.5% CO_2). The short term exposure limit for 15 minutes or less is 30,000 PPM (3% CO_2). Carbon dioxide monitors are recommended for confined areas where concentrations of carbon dioxide gas can accumulate. ▲

Store and use liquid CO_2 only in a well-ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of CO_2 gas reduce the concentration of oxygen and can result in asphyxiation. Because CO_2 gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note The cloudy vapor that appears when liquid CO_2 is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible. ▲

Never dispose of liquid CO_2 in confined areas or places where others may enter.

Disposal of liquid CO_2 should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

Appendix C First Aid

If a person seems to become dizzy or loses consciousness while working with liquid nitrogen or carbon dioxide, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.

If exposed to liquid or cold gas, restore tissue to normal body temperature (98.6° F) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 108° F. Under no circumstance should the water be over 112° F, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke nor drink alcohol.

CE Declaration of Conformity

Manufacturer: Thermo Fisher Scientific (Asheville) LLC
401 Millcreek Road
Marietta, Ohio 45750
U.S.A.

hereby declares under its sole responsibility that the following product(s)

Product Description: ULT -86°C General Purpose Freezer

Cat. No.	Model No.	Release Level(s)	Year of Initial Marking
TSE240A	930	6 & 7	2012
TSE320A	931	6 & 7	2012
TSE400A	932	6 & 7	2012
TSE240V	933	5 thru 7	2011
TSE320V	935	5 thru 7	2011
TSE400V	936	5 thru 7	2011

Cat. No.	Model No.	Release Level(s)	Year of Initial Marking
TSE600D	937	5 thru 7	2012
TSE240D	947	5 thru 7	2012
TSE320D	948	5 thru 7	2012
TSE400D	949	6 & 7	2011
TSE600V	950	6 & 7	2011

(Release Level [REL#] shown on serial tag)

This product conforms to the following European Union Directive(s):

EMC: 2004/108/EC
LVD: 2006/95/EC

This product conforms to the following Harmonized, International and National Standards:

EMC:	LVD:
EN61326-1	EN 61010-1 – 2nd Edition
EN61000-3-2	EN 60335-2-34 (applicable sections)
EN61000-3-3	CSA C22.2 No. 61010-1 2nd Edition
	UL 61010-1 2nd Edition

Mark Bartlett 18 January 2012

Mark Bartlett
Supervisor, EPD

Thermo Fisher
SCIENTIFIC

Rev. 2

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